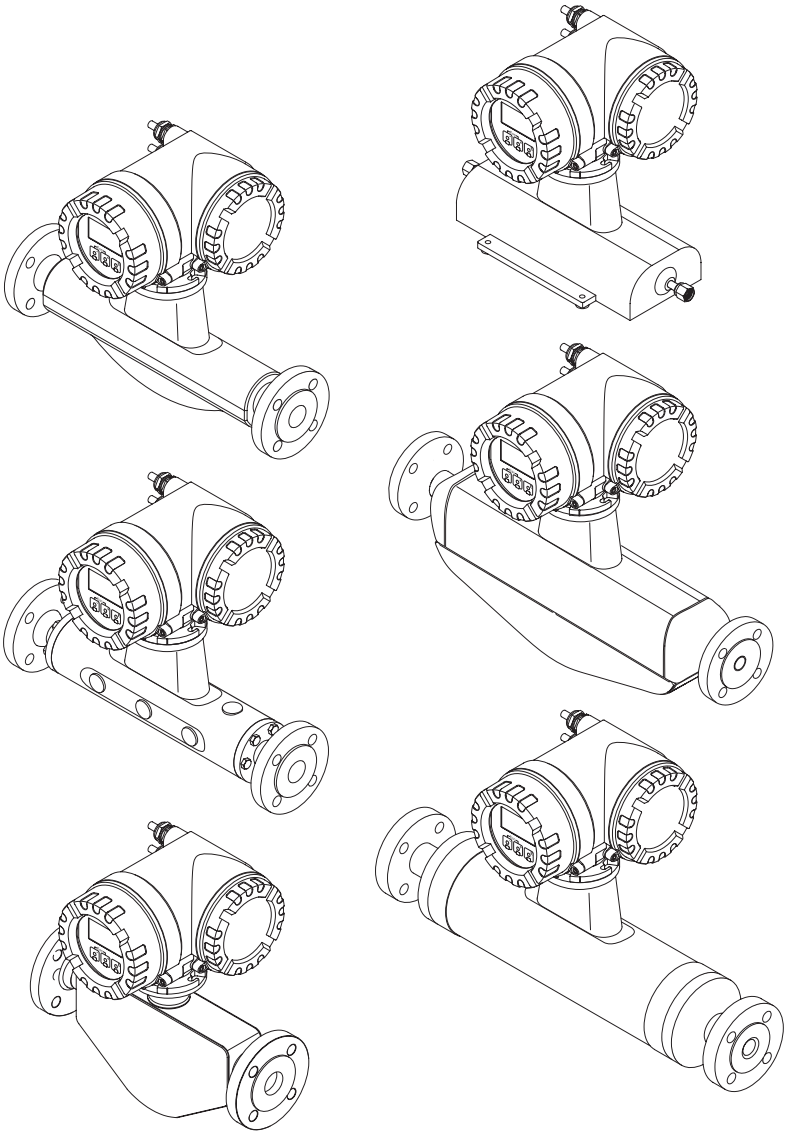
BA059D/06/en/10.03
50098470

Valid as of software version:
V 1.06.XX (amplifier)
V 1.03.XX (communication)

PROline promass 83
Coriolis Mass Flow Measuring System

Operating Instructions



Endress+Hauser
The Power of Know How

Brief operating instructions

These brief operating instructions show you how to configure your measuring device quickly and easily:

Safety instructions	Page 7

▼

Installation	Page 13

▼

Wiring	Page 25

▼

Display and operating elements	Page 35

▼

Commissioning with “QUICK SETUP”	Page 60 ff.
You can commission your measuring device quickly and easily, using the special “Quick Setup” menu. It enables you to configure important basic functions using the local display, for example display language, measured variables, units of measures, type of signal, etc. The following adjustments can be made separately as necessary: – Zero point adjustment – Density adjustment	

▼

Application specific QUICK SETUPs	Page 62 ff.
In “Quick Setup” mode you have the option of launching other, application-specific Quick Setups, for instance the menu for measuring pulsating flow, etc.	

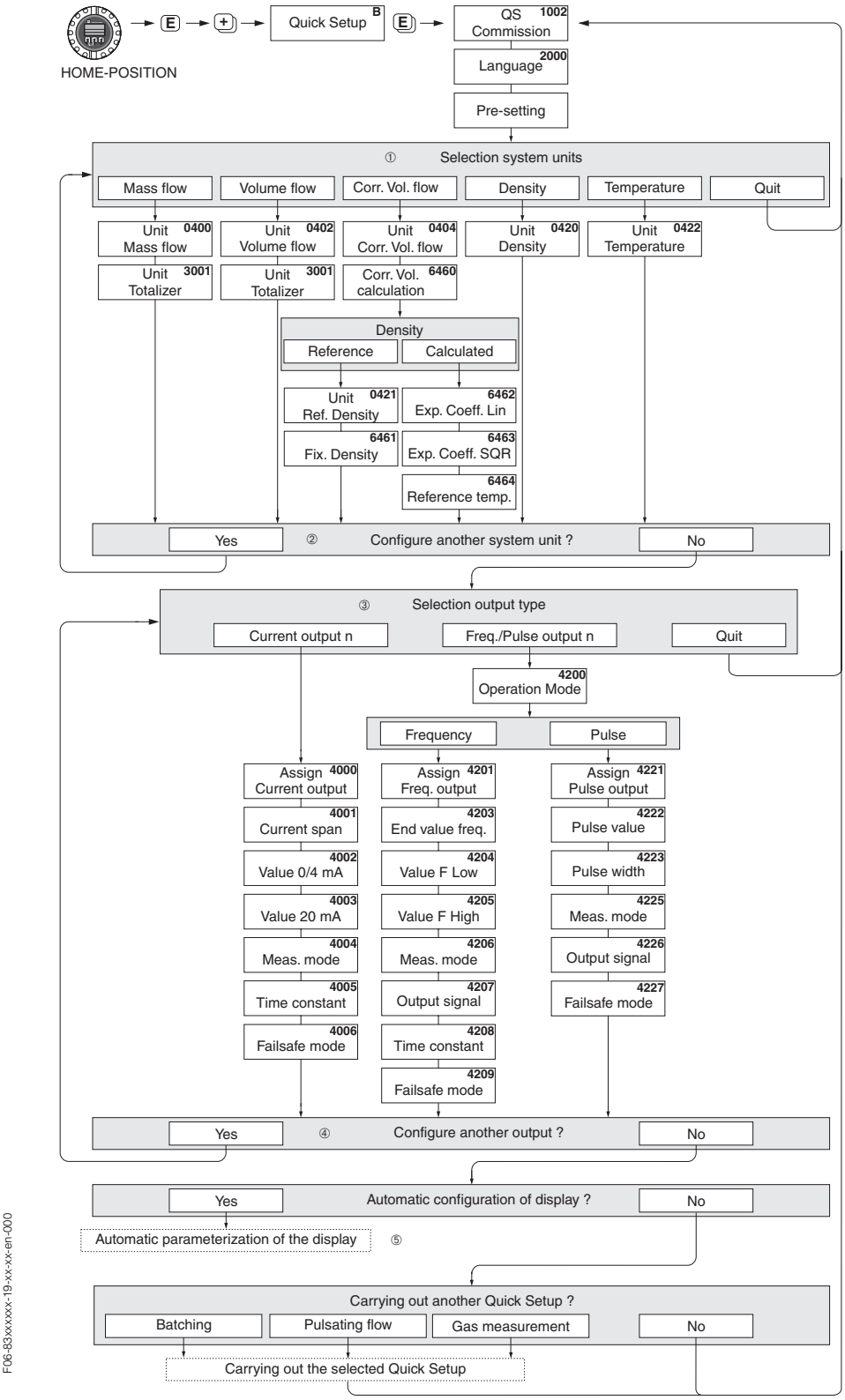
▼

Customer specific configuration	Page 40 ff.
Complex measuring operations necessitate additional functions that you can configure as necessary with the aid of the function matrix, and customise to suit your process parameters. ✎ Note: All functions are described in detail, as is the function matrix itself, in the **“Description of Device Functions”** manual, which is a separate part of these Operating Instructions.	

✎ Note:
Always start trouble-shooting with the checklist on Page 89, if faults occur after commissioning or during operation. The routine takes you directly to the cause of the problem and the appropriate remedial measures.

QUICK SETUP "Commissioning"

Note:
More detailed information on running Quick Setup menus, especially for devices without a local display, can be found on Page 60 ff.



Information on the points numbered in the Quick Setup can be found on the following page.

Note:
- The display returns to the cell QUICK SETUP COMMISSION (1002) if you press the ESC key combination during parameter interrogation. The stored parameters remain valid.
- The “Commissioning” Quick Setup must be carried out before one of the Quick Setups explained below is run.

- ① Only units not yet configured in the current Setup are offered for selection in each cycle. The unit for mass, volume and corrected volume is derived from the corresponding flow unit.

- ② The “YES” option remains visible until all the units have been configured. “NO” is the only option displayed when no further units are available.

- ③ Only the outputs not yet configured in the current Setup are offered for selection in each cycle.

- ④ The “YES” option remains visible until all the outputs have been parameterized. “NO” is the only option displayed when no further outputs are available.

- ⑤ The “automatic parameterization of the display” option contains the following basic settings/factory settings:
  YES: Main line = Mass flow; Additional line = Totalizer 1; Information line = Operating/system conditions.
  NO: The existing (selected) settings remain.

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1 Safety instructions

1.1 Designated use

The measuring device described in these Operating Instructions is to be used only for measuring the mass flow rate of fluids and gases. At the same time, the system also measures fluid density and fluid temperature. These parameters are then used to calculate other variables such as volume flow. Fluids with widely differing properties can be measured, for example:

- Chocolate, condensed milk, liquid sugar
- Oils, fats
- Acids, alkalis, lacquers, paints, solvents and cleaning agents
- Pharmaceuticals, catalysts, inhibitors
- Suspensions
- Gases, liquefied gases, etc.

Resulting from incorrect use or from use other than that designated the operational safety of the measuring devices can be suspended. The manufacturer accepts no liability for damages being produced from this.

1.2 Installation, commissioning and operation

Note the following points:
- Installation, connection to the electricity supply, commissioning and maintenance of the device must be carried out by trained, qualified specialists authorised to perform such work by the facility's owner operator. The specialist must have read and understood these Operating Instructions and must follow the instructions it contains.
- The device must be operated by persons authorised and trained by the facility's owner-operator. Strict compliance with the instructions in the Operating Instruction is mandatory.
- Endress+Hauser will be happy to assist in clarifying the chemical resistance properties of parts wetted by special fluids, including fluids used for cleaning. However the user is responsible for the choice of fluid wetted materials as regards to their in-process resistance to corrosion. The manufacturer refuses to accept liability.
- The installer must ensure that the measuring system is correctly wired in accordance with the wiring diagrams. The transmitter must be grounded, unless the power supply is galvanically insulated.
- Invariably, local regulations governing the opening and repair of electrical devices apply.

1.3 Operational safety

Note the following points:
- Measuring systems for use in hazardous environments are accompanied by separate “Ex documentation”, which is an *integral part* of these Operating Instructions. Strict compliance with the installation instructions and ratings as stated in this supplementary documentation is mandatory. The symbol on the front of this supplementary Ex documentation indicates the approval and the certification body (Ⓔx Europe, FM USA, Ⓒ Canada).
- The measuring device complies with the general safety requirements in accordance with EN 61010, the EMC requirements of EN 61326/A1, and NAMUR recommendation NE 21 and NE 43.
- The manufacturer reserves the right to modify technical data without prior notice. Your E+H distributor will supply you with current information and updates to these Operating Instructions.

1.4 Return

The following procedures must be carried out before a flowmeter requiring repair or calibration, for example, is returned to Endress+Hauser:

- Always enclose a duly completed "Declaration of contamination" form. Only then can Endress+Hauser transport, examine and repair a returned device.
- Enclose special handling instructions if necessary, for example a safety data sheet as per EN 91/155/EEC.
- Remove all residues. Pay special attention to the grooves for seals and crevices which could contain residues. This is particularly important if the substance is hazardous to health, e.g. flammable, toxic, caustic, carcinogenic, etc.
  With Promass A and Promass M the threaded process connections must first be removed from the sensor and then cleaned.

Note:
You will find a *preprinted* "Declaration of contamination" form at the back of this manual.

Warning:
- Do not return a measuring device if you are not absolutely certain that all traces of hazardous substances have been removed, e.g. substances which have penetrated crevices or diffused through plastic.
- Costs incurred for waste disposal and injury (burns, etc.) due to inadequate cleaning will be charged to the owner-operator.

1.5 Notes on safety conventions and icons

The devices are designed to meet state-of-the-art safety requirements, have been tested, and left the factory in a condition in which they are safe to operate. The devices comply with the applicable standards and regulations in accordance with EN 61010 "Protection Measures for Electrical Equipment for Measurement, Control, Regulation and Laboratory Procedures". They can, however, be a source of danger if used incorrectly or for other than the designated use.
Consequently, always pay particular attention to the safety instructions indicated in these Operating Instructions by the following icons:

Warning:
"Warning" indicates an action or procedure which, if not performed correctly, can result in injury or a safety hazard. Comply strictly with the instructions and proceed with care.

Caution:
"Caution" indicates an action or procedure which, if not performed correctly, can result in incorrect operation or destruction of the device. Comply strictly with the instructions.

Note:
"Note" indicates an action or procedure which, if not performed correctly, can have an indirect effect on operation or trigger an unexpected response on the part of the device.

2 Identification

2.1 Device designation

The “Promass 83” flow measuring system consists of the following components:
- Promass 83 transmitter
- Promass F, Promass M, Promass E, Promass A, Promass H or Promass I sensor

In the *compact version*, transmitter and sensor form a single mechanical unit; in the *remote version* they are installed separately.

2.1.1 Nameplate of the transmitter

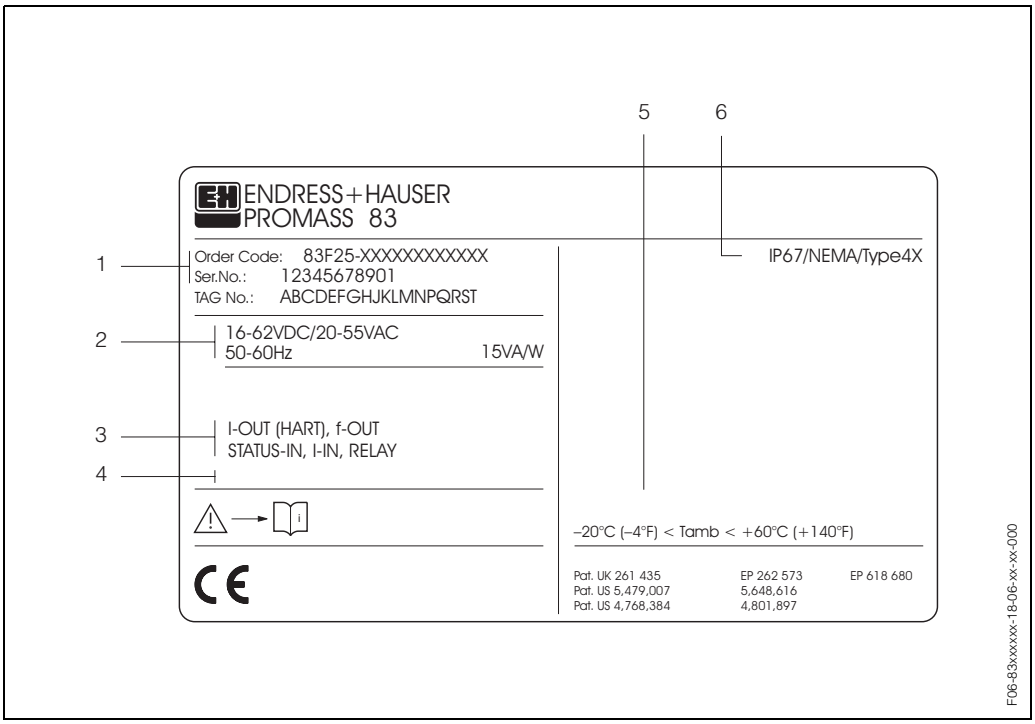


Fig. 1: Nameplate specifications for the “Promass 83” transmitter (example)

1 Ordering code/Serial number: See the specifications on the order confirmation for the meanings of the individual letters and digits.
2 Power supply / frequency: 20...55 V AC /16...62 V DC / 50...60 Hz
Power consumption: 15 VA / 15 W
3 Available inputs / outputs:
I-OUT (HART): with current output (HART)
f-OUT: with pulse/frequency output
RELAY: with relay output
I-IN: with current input
STATUS-IN: with status input (auxiliary input)
4 Reserved for information on special products
5 Ambient temperature range
6 Degree of protection

2.1.2 Nameplate of the sensor

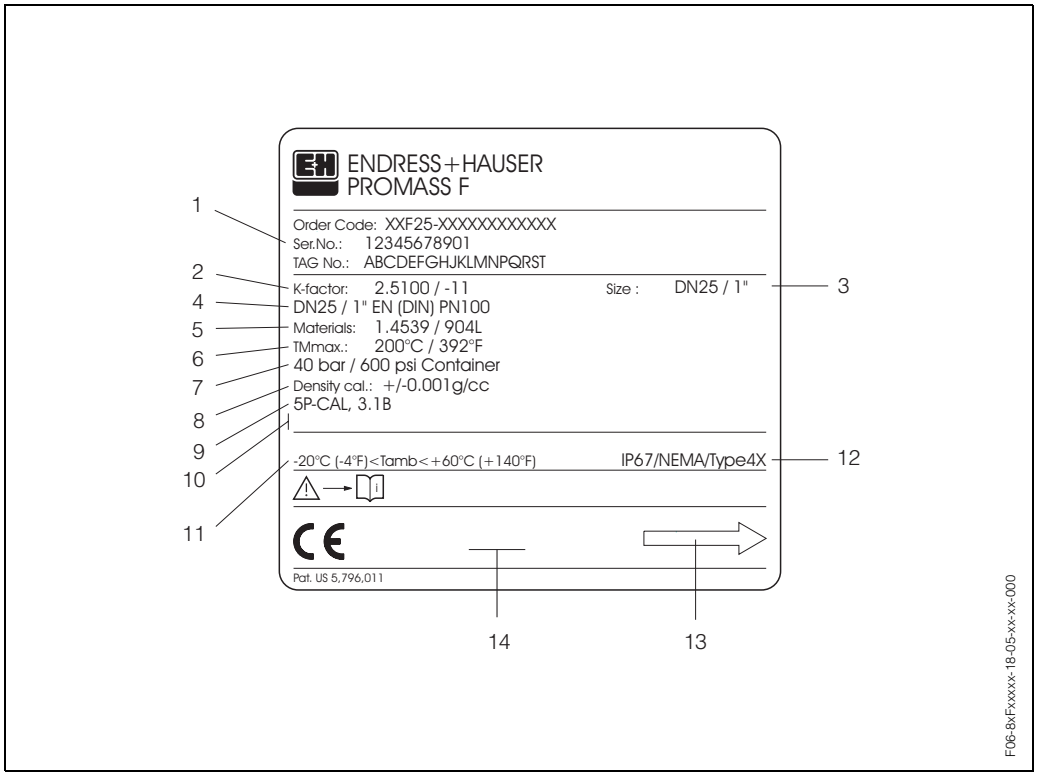


Fig. 2: Nameplate specifications for the "Promass F" sensor (example)

1 *Ordering code/Serial number: See the specifications on the order confirmation for the meanings of the individual letters and digits.*
2 *Calibration factor: 2.510; zero point: –11*
3 *Nominal diameter device: DN 25 / 1"*
4 *Nominal diameter flange: DN 25 / 1"*
Pressure rating: EN (DIN) PN 100 bar
5 *Material of measuring tubes: Stainless steel 1.4539/904L*
6 *TMmax +200 °C / +392 °F (max. fluid temperature)*
7 *Pressure range of secondary containment: max. 40 bar (600 psi)*
8 *Accuracy of density measurement: ± 0.001 g/cc*
9 *Additional information (examples):*
– With 5-point calibration
– With 3.1 B certification for fluid wetted materials
10 *Reserved for information on special products*
11 *Ambient temperature range*
12 *Degree of protection*
13 *Flow direction*
14 *Reserved for additional information on device version (approvals, certificates)*

2.2 CE mark, declaration of conformity

The devices are designed in accordance with good engineering practice to meet state-of-the-art safety requirements, have been tested, and left the factory in a condition in which they are safe to operate. The devices comply with the applicable standards and regulations in accordance with EN 61010 "Protection Measures for Electrical Equipment for Measurement, Control, Regulation and Laboratory Procedures" and with the EMC requirements of EN 61326/A1.
The measuring system described in these Operating Instructions thus complies with the statutory requirements of the EC Directives. Endress+Hauser confirms successful testing of the device by affixing to it the CE mark.

2.3 Registered trademarks

KALREZ ®, VITON ®
Registered trademarks of E.I. Du Pont de Nemours & Co., Wilmington, USA

TRI-CLAMP ®
Registered trademark of Ladish & Co., Inc., Kenosha, USA

SWAGELOK ®
Registered trademark of Swagelok & Co., Solon, USA

HART ®
Registered trademark of HART Communication Foundation, Austin, USA

S-DAT™, T-DAT™, F-Chip™, FieldTool™, FieldCheck™, Applicator™
Registered or registration-pending trademarks of Endress+Hauser Flowtec AG, Reinach, CH

3 Installation

3.1 Incoming acceptance, transport and storage

3.1.1 Incoming acceptance

On receipt of the goods, check the following points:
- Check the packaging and the contents for damage.
- Check the shipment, make sure nothing is missing and that the scope of supply matches your order.

3.1.2 Transport

The following instructions apply to unpacking and to transporting the device to its final location:

- Transport the devices in the containers in which they are delivered.
- The covers or caps fitted to the process connections prevent mechanical damage to the sealing faces and the ingress of foreign matter to the measuring tube during transportation and storage. Consequently, do not remove these covers or caps until immediately before installation.
- Do not lift measuring devices of nominal diameters DN 40...150 by the transmitter housing or the connection housing in the case of the remote version (Fig. 3). Use webbing slings slung round the two process connections. Do not use chains, as they could damage the housing.
- In the case of the Promass M / DN 80 sensor, use only the lifting eyes on the flanges to lift the assembly.

⚠ Warning:
Risk of injury if the measuring device slips. The center of gravity of the assembled measuring device might be higher than the points around which the slings are slung.
At all times, therefore, make sure that the device does not unexpectedly turn around its axis or slip.

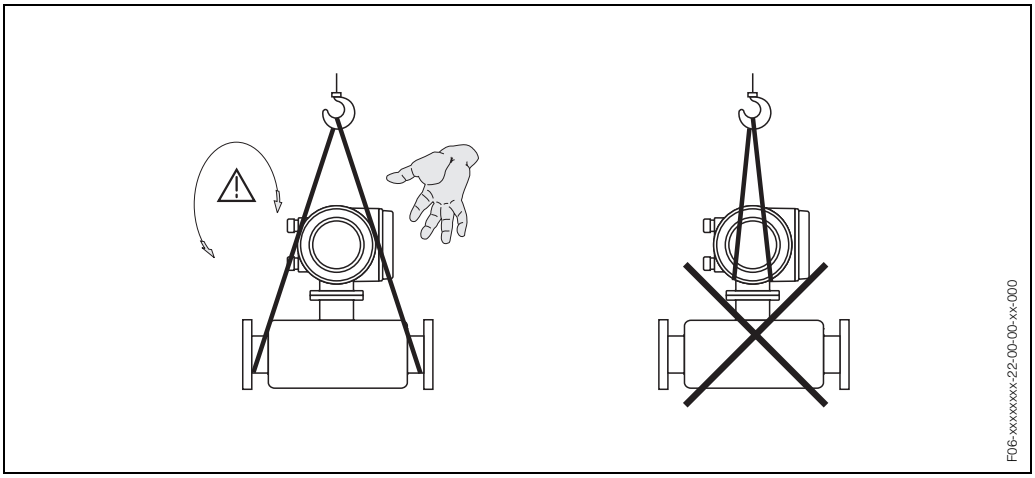


Fig. 3: Instructions for transporting sensors with DN 40...150

3.1.3 Storage

Note the following points:
- Pack the measuring device in such a way as to protect it reliably against impact for storage (and transportation). The original packaging provides optimum protection.
- The permissible storage temperature is –40...+80 °C (preferably +20 °C).
- Do not remove the protective covers or caps on the process connections until you are ready to install the device.
- The measuring device must be protected against direct sunlight during storage in order to avoid unacceptably high surface temperatures.

3.2 Installation conditions

Note the following points:
- No special measures such as supports are necessary. External forces are absorbed by the construction of the instrument, for example the secondary containment.
- The high oscillation frequency of the measuring tubes ensures that the correct operation of the measuring system is not influenced by pipe vibrations.
- No special precautions need to be taken for fittings which create turbulence (valves, elbows, T-pieces, etc.), as long as no cavitation occurs.
- For mechanical reasons and in order to protect the pipe, it is advisable to support heavy sensors.

3.2.1 Dimensions

Dimensions and the fitting lengths of the transmitter and sensor are on Page 133 ff.

3.2.2 Mounting location

Entrained gas bubbles in the measuring tube can result in an increase in measuring errors. Avoid the following locations:

- Highest point of a pipeline. Risk of air accumulating.
- Directly upstream of a free pipe outlet in a vertical pipeline.

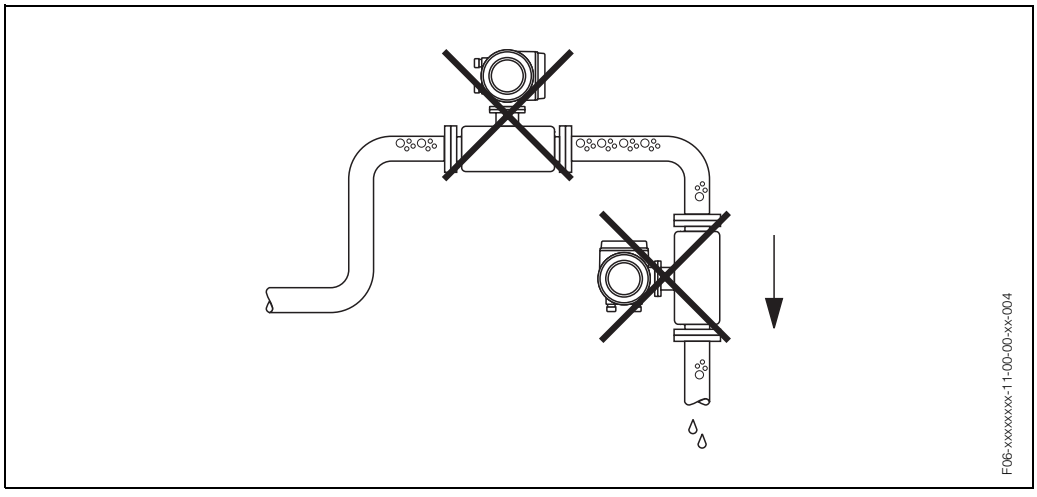


Fig. 4: Mounting location

The proposed configuration in Fig. 5, however, permits installation in a vertical pipeline. Pipe restrictors or the use of an orifice with a smaller cross-section than the nominal diameter prevent the sensor from running empty during measurement.

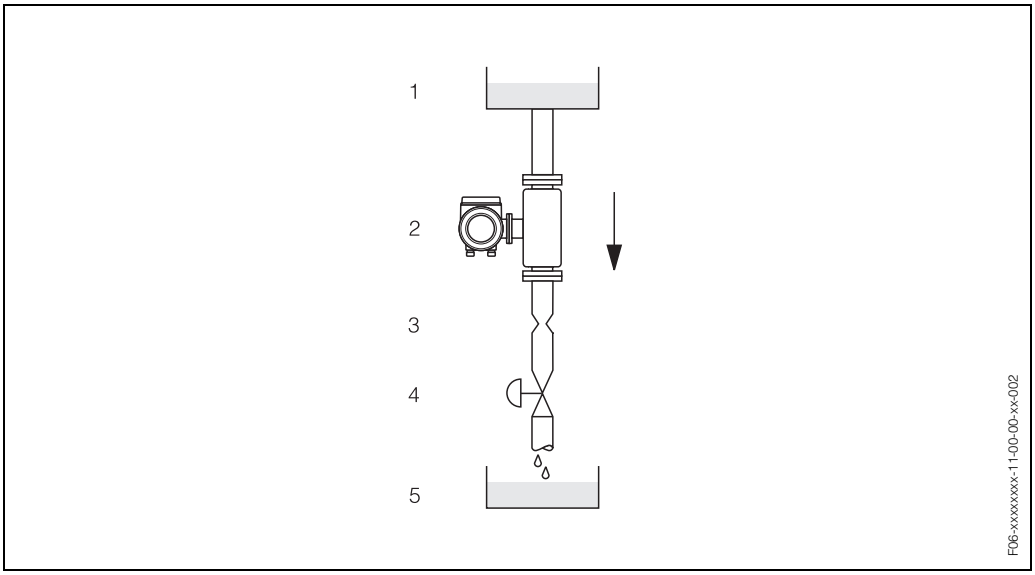


Fig. 5: Installation in a vertical pipe (e.g. for batching applications)

1 Supply tank
2 Sensor
3 Orifice, pipe restrictions (see Table)
4 Valve
5 Batching tank

Promass F, M, E / DN	8	15	25	40	50	80 [1]	100 [2]	150 [2]
Ø orifice / pipe restriction	6 mm	10 mm	14 mm	22 mm	28 mm	50 mm	65 mm	90 mm

[1] Promass F, M only
[2] Promass F only

Promass A / DN	1	2	4
Ø orifice / pipe restriction	0.8 mm	1.5 mm	3.0 mm

Promass H, I / DN	8	15	15 [1]	25	25 [1]	40	40 [1]	50
Ø orifice / pipe restriction	6 mm	10 mm	15 mm	14 mm	24 mm	22 mm	35 mm	28 mm

[1] DN 15, 25, 40 “FB” = Full bore versions of Promass I

System pressure

It is important to ensure that cavitation does not occur, because it would influence the oscillation of the measuring tube. No special measures need to be taken for fluids which have properties similar to water under normal conditions.
In the case of liquids with a low boiling point (hydrocarbons, solvents, liquefied gases) or in suction lines, it is important to ensure that pressure does not drop below the vapour pressure and that the liquid does not start to boil. It is also important to ensure that the gases that occur naturally in many liquids do not outgas. Such effects can be prevented when system pressure is sufficiently high.

Consequently, it is generally best to install the sensor:
- downstream from pumps (no danger of vacuum),
- at the lowest point in a vertical pipe.

3.2.3 Orientation

Make sure that the direction of the arrow on the nameplate of the sensor matches the direction of flow (direction in which the fluid flows through the pipe).

Orientation Promass A

Vertical:
Recommended orientation with upward direction of flow. When fluid is not flowing, entrained solids will sink down and gases will rise away from the measuring tube.
The measuring tubes can be completely drained and protected against solids build-up.

Horizontal:
When installation is correct the transmitter housing is above or below the pipe. This arrangement means that no gas or solid deposits can accumulate in the curved measuring tube (single-tube system).
Do not install the sensor in such a way that it is suspended in the pipe, in other words without support or attachment. This is to avoid excessive strain at the process connection. The base plate of the sensor housing is designed for mounting on a tabletop, wall or post.

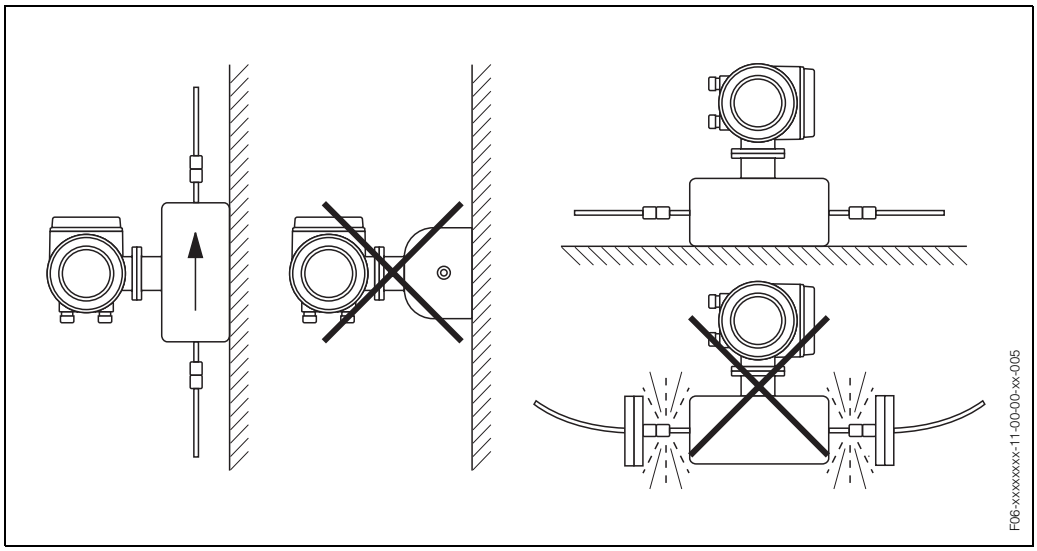


Fig. 6: Vertical and horizontal orientation (Promass A)

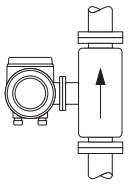
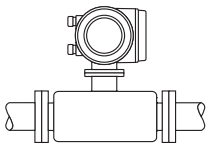
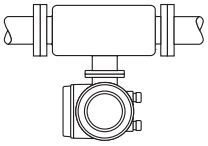
Orientation Promass F, M, E, H, I

Make sure that the direction of the arrow on the nameplate of the sensor matches the direction of flow (direction in which the fluid flows through the pipe).

Vertical:
Recommended orientation with upward direction of flow (View V). When fluid is not flowing, entrained solids will sink down and gases will rise away from the measuring tube. The measuring tubes can be completely drained and protected against solids build-up.

Horizontal (Promass F, M, E):
The measuring tubes of Promass F, M and E must be horizontal and beside each other. When installation is correct the transmitter housing is above or below the pipe (View H1/H2). Always avoid having the transmitter housing in the same horizontal plane as the pipe.

Horizontal (Promass H, I):
Promass H and Promass I can be installed in any orientation in a horizontal pipe run.

	Promass F, M, E, H, I Standard, compact	**Promass F, M, E, H, I** Standard, remote	**Promass F** High-temperature, compact	**Promass F** High-temperature, remote
Vertical orientation (View V) 	✓✓	✓✓	✓✓	✓✓
Horizontal orientation (View H1) Transmitter head up 	✓✓	✓✓	✗ (T_M = >200 °C) ①	✓ (T_M = >200 °C) ①
Horizontal orientation (View H2) Transmitter head down 	✓✓ ②	✓✓ ②	✓✓ ②	✓✓ ②

✓✓ = Recommended orientation
✓ = Orientation recommended in certain situations
✗ = Impermissible orientation

In order to ensure that the maximum permissible ambient temperature for the transmitter (–20...+60 °C, optional –40...+60 °C) is not exceeded, we recommend the following orientations:

① = For fluids with very high temperatures (> 200 °C), we recommend the horizontal orientation with the transmitter head pointing downwards (Fig. H2) or the vertical orientation (Fig. V)

② = For fluids with low temperatures, we recommend the horizontal orientation with the transmitter head pointing upwards (Fig. H1) or the vertical orientation (Fig. V).

Special installation instructions for Promass F, E and H

Caution:
The two measuring tubes of Promass F and Promass E and the one of Promass H are slightly curved. The position of the sensor, therefore, has to be matched to the fluid properties when the sensor is installed horizontally (Fig. 7).

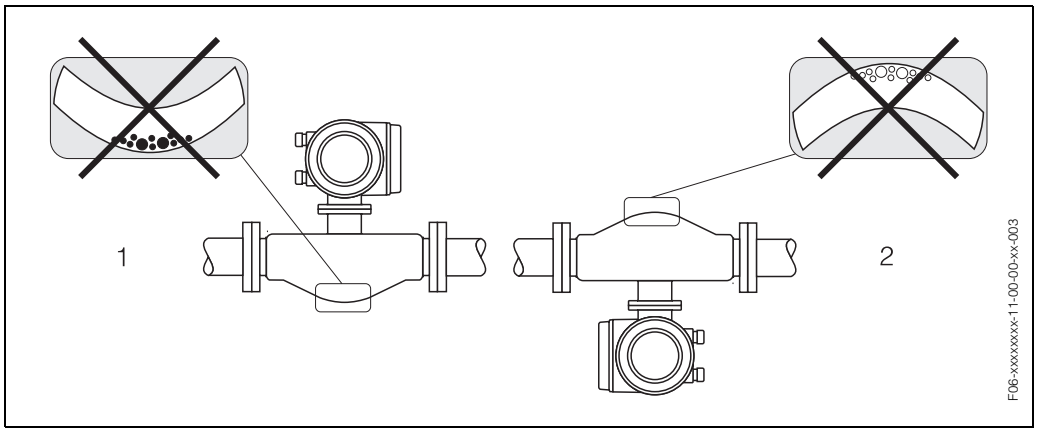


Fig. 7: Promass F, E, H installed horizontally

1 Not suitable for fluids with entrained solids. Risk of solids accumulating.
2 Not suitable for outgassing fluids. Risk of gas accumulating.

3.2.4 Heating

Some fluids require suitable measures to avoid loss of heat at the sensor. Heating can be electric, e.g. with heated elements, or by means of hot water or steam pipes made of copper.

Caution:
- Risk of electronics overheating! Consequently, make sure that the adapter between sensor and transmitter and the connection housing of the remote version always remain free of insulating material. Note that a certain orientation might be required, depending on the fluid temperature (see Section 3.2.3 “Fluid temperature”).
- With a fluid temperature between 200...350 °C, heating is not permitted for the compact version of the high-temperature version.
- When using electrical heat tracing whose heat is regulated using phase control or by pulse packs, it cannot be ruled out that the measured values are influenced by magnetic fields which may occur, i.e. at values greater than those permitted by the EC standard (Sinus 30 A/m). In such cases, the sensor must be magnetically screened (except for Promass M).
  The secondary containment can be shielded with tin plates or electric sheets without privileged direction (e.g. V330-35A) with the following properties:
  – Relative magnetic permeability $\mu_r \geq 300$
  – Plate thickness $d \geq 0.35$ mm

• Information on permissible temperature ranges → Page 119.

Special heating jackets which can be ordered as accessories from Endress+Hauser are available for the sensors.

3.2.5 Thermal insulation

Some fluids require suitable measures to avoid loss of heat at the sensor. A wide range of materials can be used to provide the required thermal insulation.

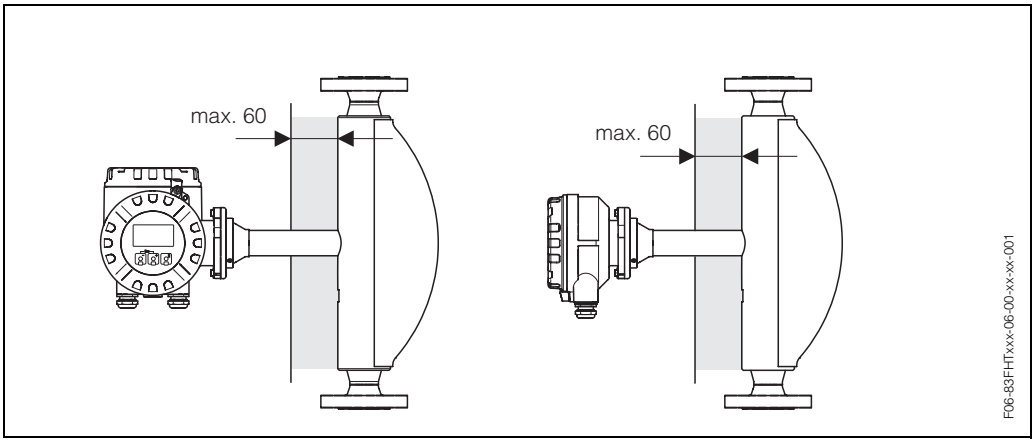


Fig. 8: In the case of the Promass F high-temperature version, a maximum insulation thickness of 60 mm must be observed in the area of the electronics/neck.

If the Promass F high-temperature version is installed horizontally (with transmitter head pointing upwards), an insulation thickness of min. 10 mm is recommended to reduce convection. The maximum insulation thickness of 60 mm must be observed (see Fig. 8).

3.2.6 Inlet and outlet runs

There are no installation requirements regarding inlet and outlet runs. If possible, install the sensor well clear of fittings such as valves, T-pieces, elbows, etc.

3.2.7 Vibrations

The high oscillation frequency of the measuring tubes ensures that the correct operation of the measuring system is not influenced by pipe vibrations. Consequently, the sensors require no special measures for attachment.

3.2.8 Limiting flow

See the information on Page 111 and 120.

3.3 Installation instructions

3.3.1 Turning the transmitter housing

Turning the aluminium field housing

⚠ Warning:
The turning mechanism in devices with EEx d/de or FM/CSA Cl. I Div. 1 classification is not the same as that described here. The procedure for turning these housings is described in the Ex-specific documentation.

1. Loosen the two securing screws.
2. Turn the bayonet catch as far as it will go.
3. Carefully lift the transmitter housing as far as it will go.
4. Turn the transmitter housing to the desired position (max. 2 x 90° in either direction).
5. Lower the housing into position and re-engage the bayonet catch.
6. Retighten the two securing screws.

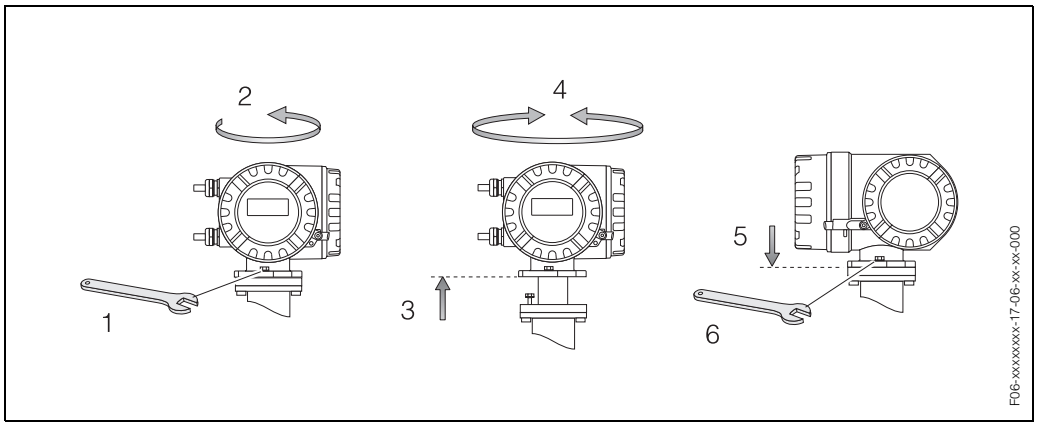


Fig. 9: Turning the transmitter housing (aluminium field housing)

Turning the stainless steel field housing

1. Loosen the two securing screws.
2. Carefully lift the transmitter housing as far as it will go.
3. Turn the transmitter housing to the desired position (max. 2 x 90° in either direction).
4. Lower the housing into position.
5. Retighten the two securing screws.

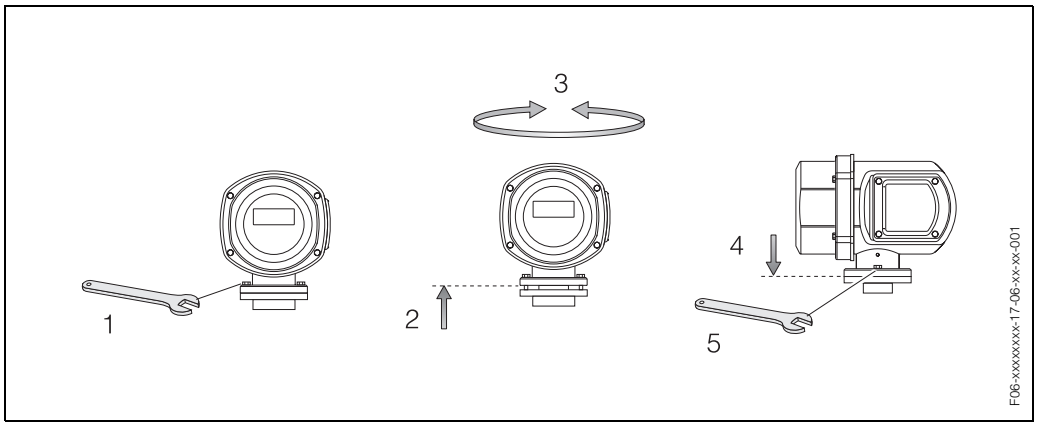


Fig. 10: Turning the transmitter housing (stainless steel field housing)

3.3.2 Installing the wall-mount transmitter housing

There are various ways of installing the wall-mount transmitter housing:
- Mounted directly on the wall
- Installation in control panel (separate mounting set, accessories → Page 87)
- Pipe mounting (separate mounting set, accessories → Page 87)

Caution:
- Make sure that ambient temperature does not go beyond the permissible range (–20...+60 °C). Install the device in a shady location. Avoid direct sunlight.
- Always install the wall-mount housing in such a way that the cable entries are pointing down.

Direct wall mounting

1. Drill the holes as illustrated in Fig. 11.
2. Remove the cover of the connection compartment (a).
3. Push the two securing screws (b) through the appropriate bores (c) in the housing.
   – Securing screws (M6): max. Ø 6.5 mm
   – Screw head: max. Ø 10.5 mm
4. Secure the transmitter housing to the wall as indicated.
5. Screw the cover of the connection compartment (a) firmly onto the housing.

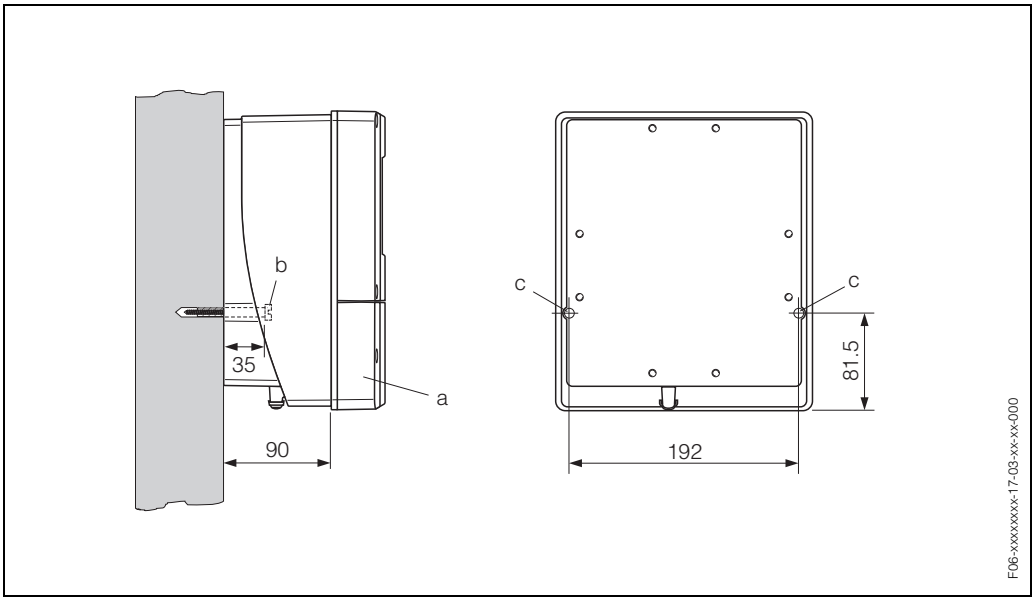


Fig. 11: Mounted directly on the wall

Installation in control panel

1. Prepare the opening in the panel (Fig. 12).
2. Slide the housing into the opening in the panel from the front.
3. Screw the fasteners onto the wall-mount housing.
4. Place the threaded rods in the fasteners and screw them down until the housing is seated tightly against the panel. Afterwards, tighten the locking nuts. Additional support is not necessary.

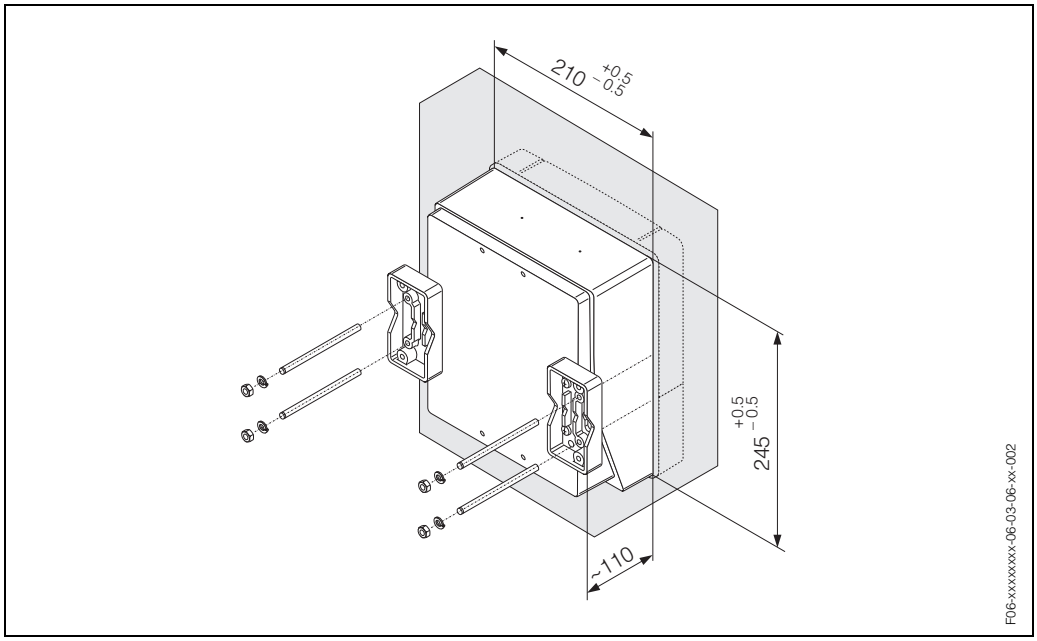


Fig. 12: Panel Installation (wall-mount housing)

Pipe mounting
The assembly should be performed by following the instructions in Fig. 13.

Caution:
If the device is mounted to a warm pipe, make certain that the housing temperature does not exceed +60 °C, which is the maximum permissible temperature.

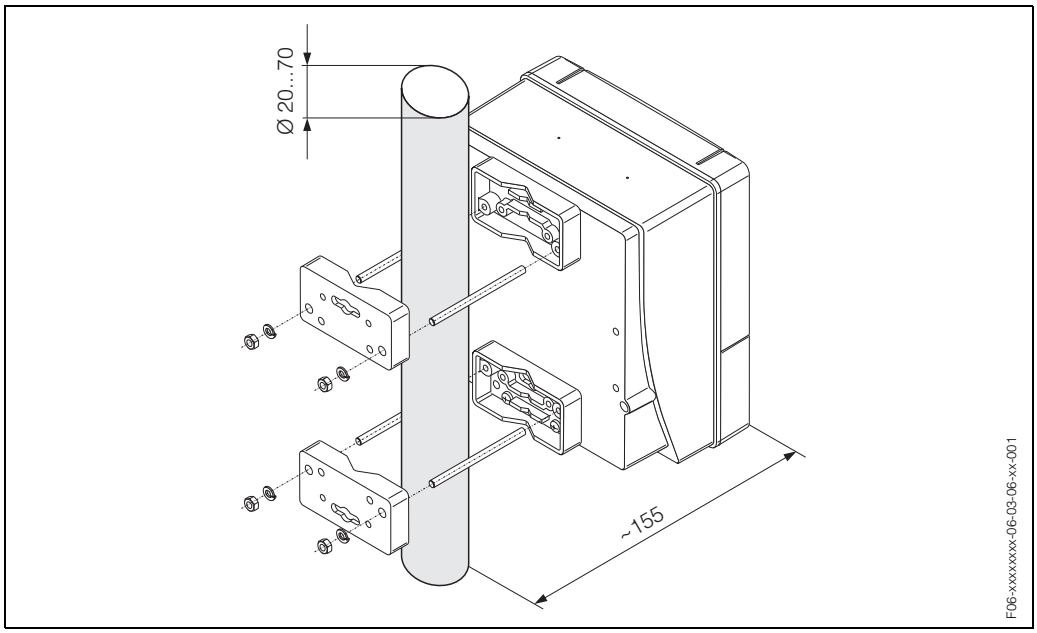


Fig. 13: Pipe mounting (wall-mount housing)

3.3.3 Turning the local display

1. Remove the cover of the electronics compartment.
2. Press the side latches on the display module and remove it from the electronics compartment cover plate.
3. Rotate the display to the desired position (max. 4 x 45° in each direction), and reset it into the electronics compartment cover plate.
4. Screw the cover of the electronics compartment firmly onto the transmitter housing.

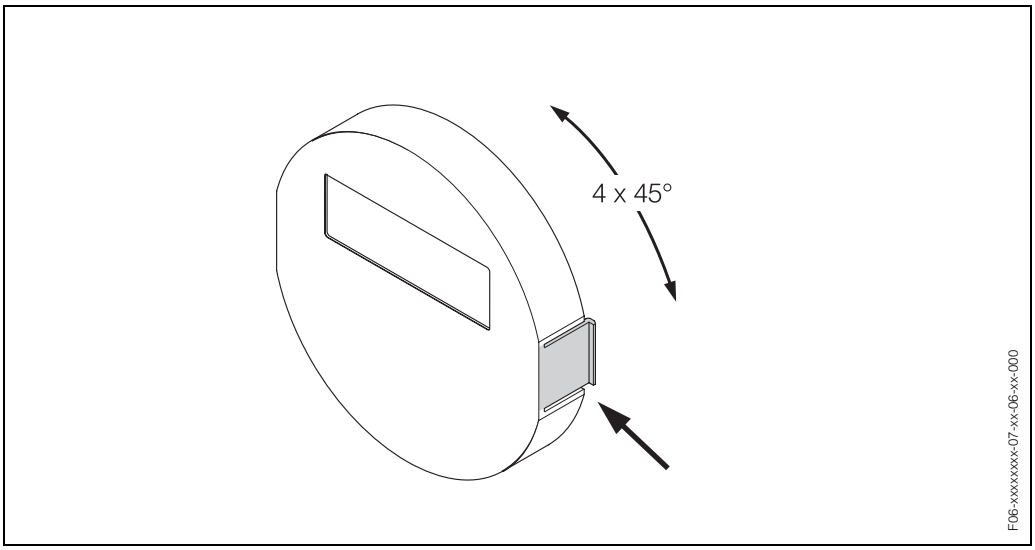


Fig. 14: Turning the local display (field housing)

3.4 Post installation check

Perform the following checks after installing the measuring device in the pipe:

Device condition and specifications	Notes
Is the device damaged (visual inspection)?	–
Does the device correspond to specifications at the measuring point, including process temperature and pressure, ambient temperature, measuring range, etc.?	see Page 111 ff.
Installation	Notes
Does the arrow on the sensor nameplate match the direction of flow through the pipe?	–
Are the measuring point number and labeling correct (visual inspection)?	–
Is the orientation chosen for the sensor correct, in other words suitable for sensor type, fluid properties (outgassing, with entrained solids) and fluid temperature?	see Page 14 ff.
Process environment / process conditions	Notes
Is the measuring device protected against moisture and direct sunlight?	–

4 Wiring

Warning:
When connecting Ex-certified devices, see the notes and diagrams in the Ex-specific supplement to these Operating Instructions. Please do not hesitate to contact your E+H representative if you have any questions.

4.1 Connecting the remote version

4.1.1 Connecting the sensor

Warning:
- Risk of electric shock. Switch off the power supply before opening the device. Do not install or wire the device while it is connected to the power supply. Failure to comply with this precaution can result in irreparable damage to the electronics.
- Risk of electric shock. Connect the protective conductor to the ground terminal on the housing before the power supply is applied.
- For the remote version, always make sure that you connect the sensor only to the transmitter having the same serial number. Communication errors can occur if the devices are not connected in this way.

1. Remove the cover (a) of the connection compartment from the transmitter and the sensor by loosening the screws.
2. Feed the signal cable (b) through the appropriate cable entries.
3. Establish the connections between sensor and transmitter in accordance with the wiring diagram:
   → Fig. 15
   → wiring diagram inside cover
4. Secure the cover (a) on the sensor connection housing and on the transmitter housing.

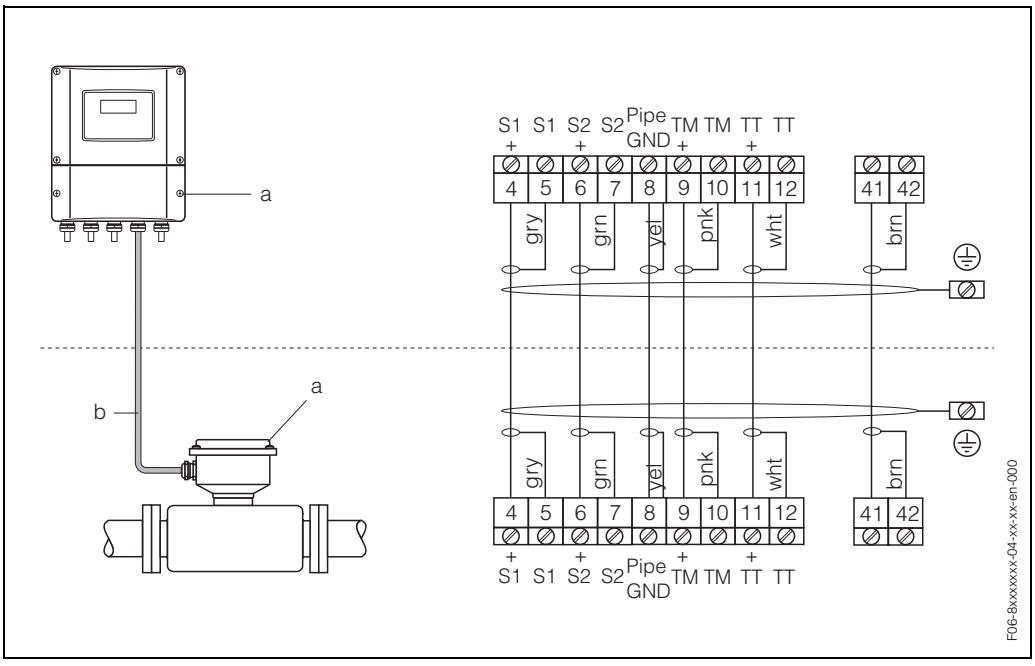


Fig. 15: Connecting the remote version

a Covers of the connection compartments (transmitter, sensor)
b Connecting cable (signal cable)

4.1.2 Cable specifications

The specifications of the cable connecting the transmitter and the sensor of the remote version are as follows:

- 6 x 0.38 mm^2 PVC cable with common shield and individually shielded cores.
- Conductor resistance: ≤ 50 Ω/km
- Capacitance: core/shield: ≤ 420 pF/m
- Cable length: max. 20 m
- Permanent operating temperature: max. +105 °C

4.2 Connecting the measuring unit

4.2.1 Transmitter (aluminium)

Warning:
- Risk of electric shock. Switch off the power supply before opening the device. Do not install or wire the device while it is connected to the power supply. Failure to comply with this precaution can result in irreparable damage to the electronics.
- Risk of electric shock. Connect the protective conductor to the ground terminal on the housing before the power supply is applied.
- Compare the specifications on the nameplate with the local voltage supply and frequency. The national regulations governing the installation of electrical equipment also apply.

1. Remove the cover of the connection compartment (f) from the transmitter housing.
2. Feed the power supply cable (a) and signal cables (b) through the appropriate cable entries.
3. Connect the cables in accordance with the wiring diagram:
   – Wiring diagram (aluminium housing) → Fig. 16
   – Wiring diagram (stainless steel housing) → Fig. 17
   – Wiring diagram (wall-mount housing) → Fig. 18
   – Terminal assignment → Page 29
4. Screw the cover of the connection compartment (f) firmly onto the transmitter housing.

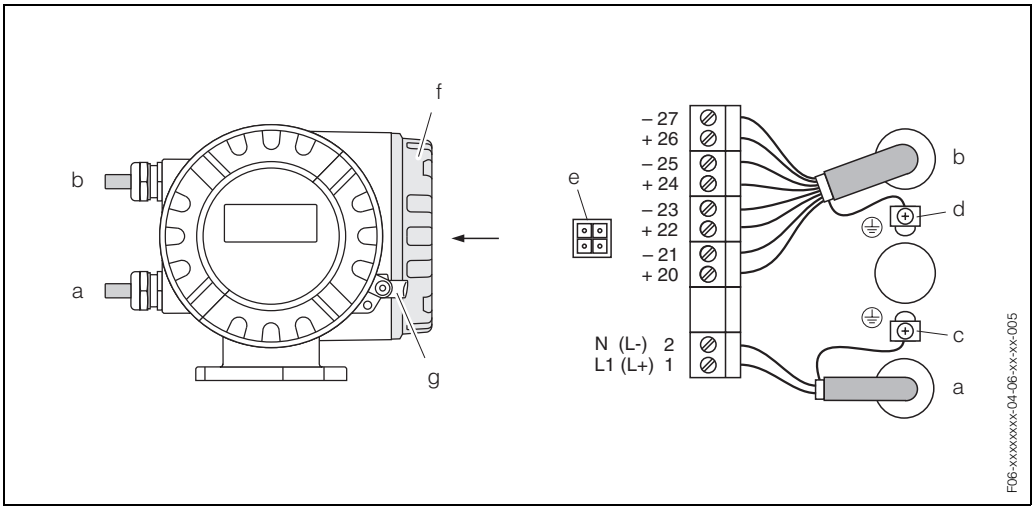


Fig. 16: Connecting the transmitter (aluminium field housing). Cable cross-section: max. 2.5 mm²

a Cable for power supply: 85...260 V AC, 20...55 V AC, 16...62 V DC
*Terminal **No. 1**: L1 for AC, L+ for DC*
*Terminal **No. 2**: N for AC, L– for DC*
*b Signal cable: Terminals **Nos. 20–27** → Page 29*
c Ground terminal for protective conductor
d Ground terminal for signal cable shield
e Service adapter for connecting service interface FXA 193 (FieldCheck, FieldTool)
f Cover of the connection compartment
g Securing clamp

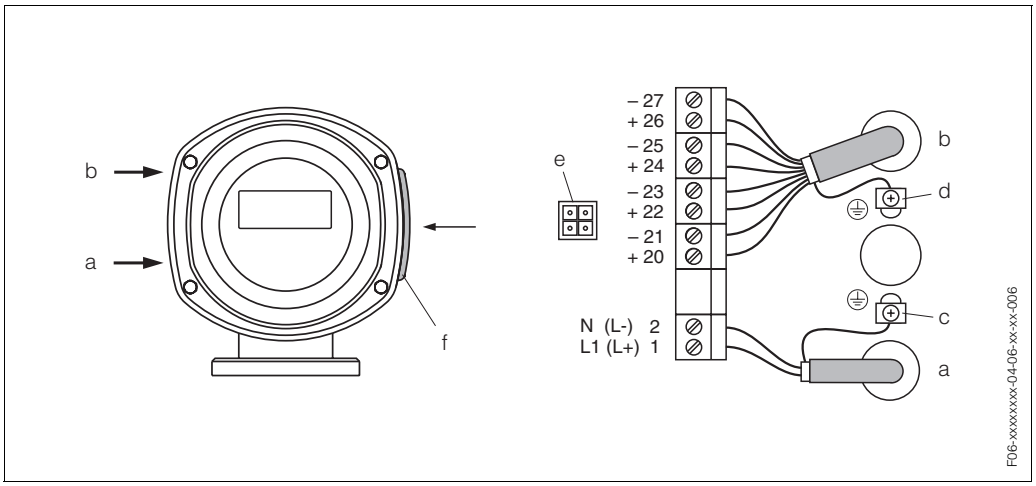


Fig. 17: Connecting the transmitter (stainless-steel field housing). Cable cross-section: max. 2.5 mm²

a Cable for power supply: 85...260 V AC, 20...55 V AC, 16...62 V DC
*Terminal **No. 1**: L1 for AC, L+ for DC*
*Terminal **No. 2**: N for AC, L– for DC*
*b Signal cable: Terminals **Nos. 20–27** → Page 29*
c Ground terminal for protective conductor
d Ground terminal for signal cable shield
e Service adapter for connecting service interface FXA 193 (FieldCheck, FieldTool)
f Cover of the connection compartment

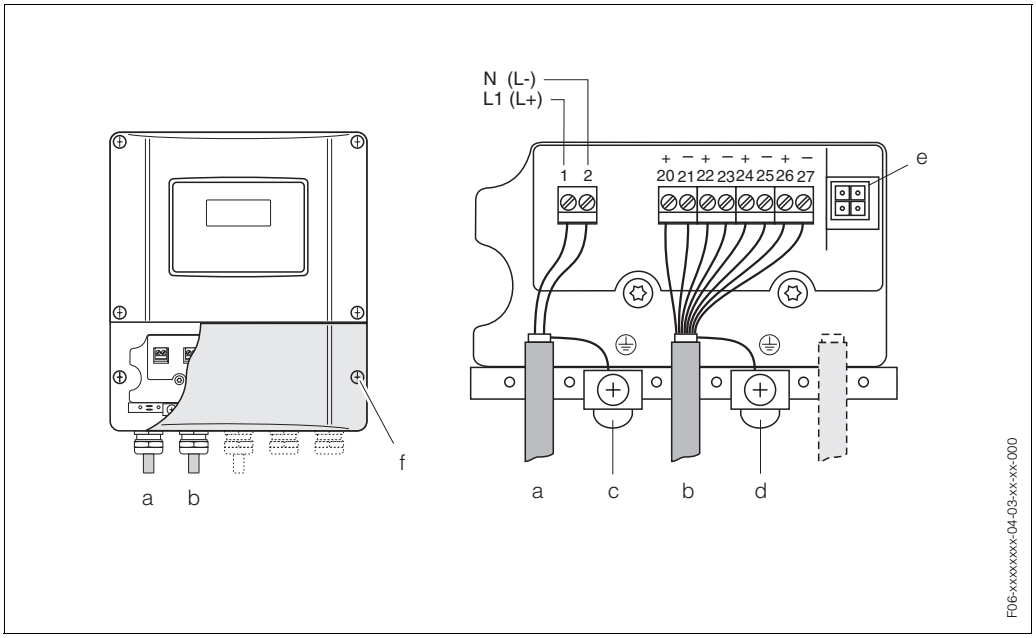


Fig. 18: Connecting the transmitter (wall-mount housing). Cable cross-section: max. 2.5 mm²

a Cable for power supply: 85...260 V AC, 20...55 V AC, 16...62 V DC
*Terminal **No. 1**: L1 for AC, L+ for DC*
*Terminal **No. 2**: N for AC, L– for DC*
*b Signal cable: Terminals **Nos. 20–27** → Page 29*
c Ground terminal for protective conductor
d Ground terminal for signal cable shield
e Service adapter for connecting service interface FXA 193 (FieldCheck, FieldTool)
f Cover of the connection compartment

4.2.2 Terminal assignment

Order variant	Terminal Nos. (inputs/outputs)			
	20 (+) / 21 (–)	22 (+) / 23 (–)	24 (+) / 25 (–)	26 (+) / 27 (–)
Fixed communication boards (permanent assignment)				
83***-**********A	–	–	Frequency output	Current output HART
83***-**********B	Relay output	Relay output	Frequency output	Current output HART
83***-**********F	–	–	–	PROFIBUS-PA Ex i
83***-**********G	–	–	–	FOUNDATION Fieldbus, Ex i
83***-**********H	–	–	–	PROFIBUS-PA
83***-**********J	–	–	–	PROFIBUS-DP
83***-**********K	–	–	–	FOUNDATION Fieldbus
83***-**********R	–	–	Current output 2 Ex i, active	Current output 1 Ex i active, HART
83***-**********S	–	–	Frequency output Ex i, passive	Current output Ex i active, HART
83***-**********T	–	–	Frequency output Ex i, passive	Current output Ex i passive, HART
83***-**********U	–	–	Current output 2 Ex i, passive	Current output 1 Ex i passive, HART
Flexible communication boards				
83***-**********C	Relay output 2	Relay output 1	Frequency output	Current output HART
83***-**********D	Status input	Relay output	Frequency output	Current output HART
83***-**********E	Status input	Relay output	Current output 2	Current output 1 HART
83***-**********L	Status input	Relay output 2	Relay output 1	Current output HART
83***-**********M	Status input	Frequency output 2	Frequency output 1	Current output HART
83***-**********W	Relay output	Current output 3	Current output 2	Current output 1 HART
83***-**********0	Status input	Current output 3	Current output 2	Current output 1 HART
83***-**********2	Relay output	Current output 2	Frequency output	Current output 1 HART
83***-**********3	Current input	Relay output	Current output 2	Current output 1 HART
83***-**********4	Current input	Relay output	Frequency output	Current output HART
83***-**********5	Status input	Current input	Frequency output	Current output HART
83***-**********6	Status input	Current input	Current output 2	Current output HART

Electrical values for inputs/outputs

Status input (auxiliary input):
galvanically isolated, 3...30 V DC, R_i = 5 kΩ, configurable

Current input:
active/passive selectable, galvanically isolated, resolution: 2 µA
- active: 4...20 mA, $R_i \leq 150\ \Omega$, U_{out} = 24 V DC, short-circuit proof
- passive: 0/4...20 mA, $R_i \leq 150\ \Omega$, U_{max} = 30 V DC

Relay output:
- max. 60 V DC / 0.1 A, max. 30 V AC / 0.5 A; configurable

Frequency output:
active/passive selectable, galvanically isolated
- active: 24 V DC, 25 mA (max. 250 mA during 20 ms), $R_L > 100\ \Omega$
- passive: open collector, 30 V DC, 250 mA

- Frequency output: full scale frequ. 2...10000 Hz (f_{max} = 12500 Hz), on/off ratio 1:1, pulse width max. 2 s
- pulse output: pulse value and pulse polarity selectable, pulse width configurable (0.05…2000 ms)

Current output (active/passive):
galvanically isolated,
- active: 0/4...20 mA, $R_L < 700\ \Omega$ (HART: $R_L \geq 250\ \Omega$),
- passive: 4...20 mA; supply voltage V_S 18...30 V DC; $R_L \leq 700\ \Omega$

4.2.3 HART connection

Users have the following connection options at their disposal:
- Direct connection to transmitter by means of terminals 26 / 27
- Connection by means of the 4...20 mA circuit

Note:
- The measuring loop's minimum load must be at least 250 Ω.
- The CURRENT SPAN function must be set to "4–20 mA" (individual options see device function).
- See also the documentation issued by the HART Communication Foundation, and in particular HCF LIT 20: "HART, a technical summary".

Connection of the HART handheld communicator
See also the documentation issued by the HART Communication Foundation, and in particular HCF LIT 20: "HART, a technical summary".

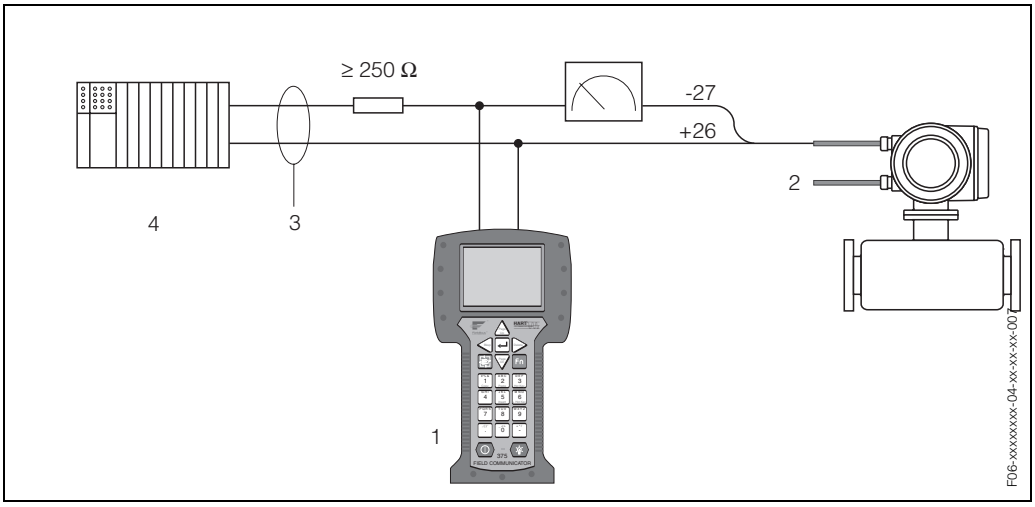


Fig. 19: Electrical connection of the HART handheld communicator:
1 = HART communicator, 2 = power supply, 3 = shield, 4 = other evaluation devices or PLC with passive input

Connection of a PC with an operating software
In order to connect a PC with an operating software (e.g. "FieldTool"), a HART modem (e.g. "Commubox FXA 191") is needed.

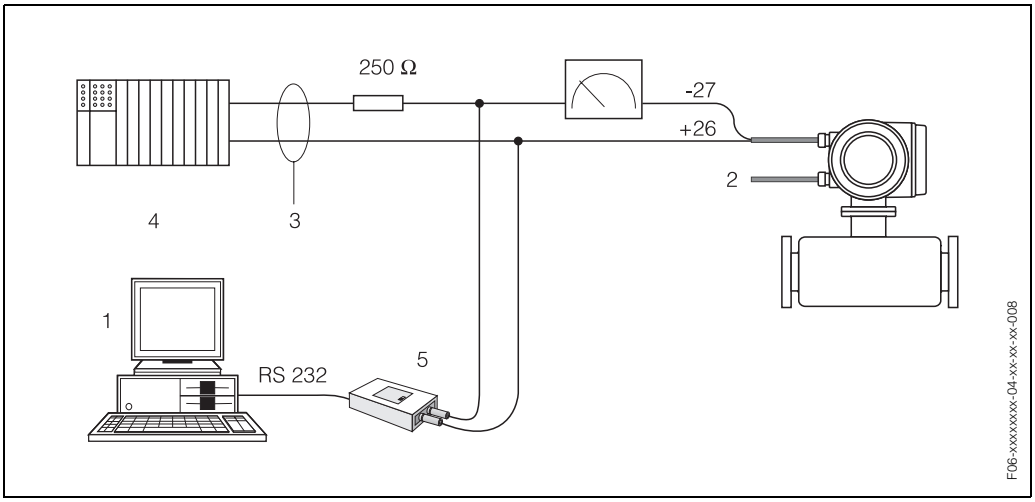


Fig. 20: Electrical connection of a PC with an operating software:
1 = PC with an operating software, 2 = power supply, 3 = shield, 4 = other evaluation devices or PLC with passive input, 5 = HART modem, e.g. Commubox FXA 191

4.3 Degree of protection

The devices fulfill all the requirements for IP 67. Compliance with the following points is mandatory following installation in the field or servicing, in order to ensure that IP 67 protection is maintained:

- The housing seals must be clean and undamaged when inserted into their grooves. The seals must be dried, cleaned or replaced if necessary.
- All threaded fasteners and screw covers must be firmly tightened.
- The cables used for connection must be of the specified outside diameter (see Page 114).
- Firmly tighten the cable entries (Fig. 21).
- The cables must loop down before they enter the cable entries (“water trap”, Fig. 21). This arrangement prevents moisture penetrating the entry. Always install the measuring device in such a way that the cable entries do not point up.
- Remove all unused cable entries and insert plugs instead.
- Do not remove the grommet from the cable entry.

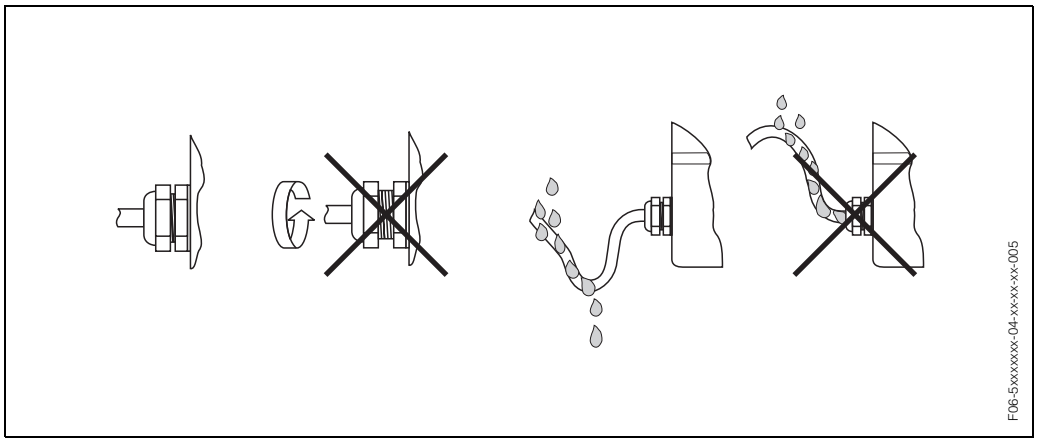


Fig. 21: Installation instructions, cable entries

4.4 Post connection check

Perform the following checks after completing electrical installation of the measuring device:

Device condition and specifications	Notes
Are cables or the device damaged (visual inspection)?	–
Electrical connection	Notes
Does the supply voltage match the specifications on the nameplate?	85...260 V AC (45...65 Hz) 20...55 V AC (45...65 Hz) 16...62 V DC
Do the cables comply with the specifications?	see Page 26, 114
Do the cables have adequate strain relief?	–
Cables correctly segregated by type? Without loops and crossovers?	–
Are the power supply and signal cables correctly connected?	See the wiring diagram inside the cover of the terminal compartment
Are all screw terminals firmly tightened?	–
Are all cable entries installed, firmly tightened and correctly sealed? Cables looped as “water traps”?	see Page 32
Are all housing covers installed and firmly tightened?	–

5 Operation

5.1 Display and operating elements

The local display enables you to read all important parameters directly at the measuring point and configure the device using the “Quick Setup” or the function matrix.

The display consists of four lines; this is where measured values and/or status variables (direction of flow, empty pipe, bar graph, etc.) are displayed. You can change the assignment of display lines to different variables to suit your needs and preferences (→ see the “Description of Device Functions” manual).

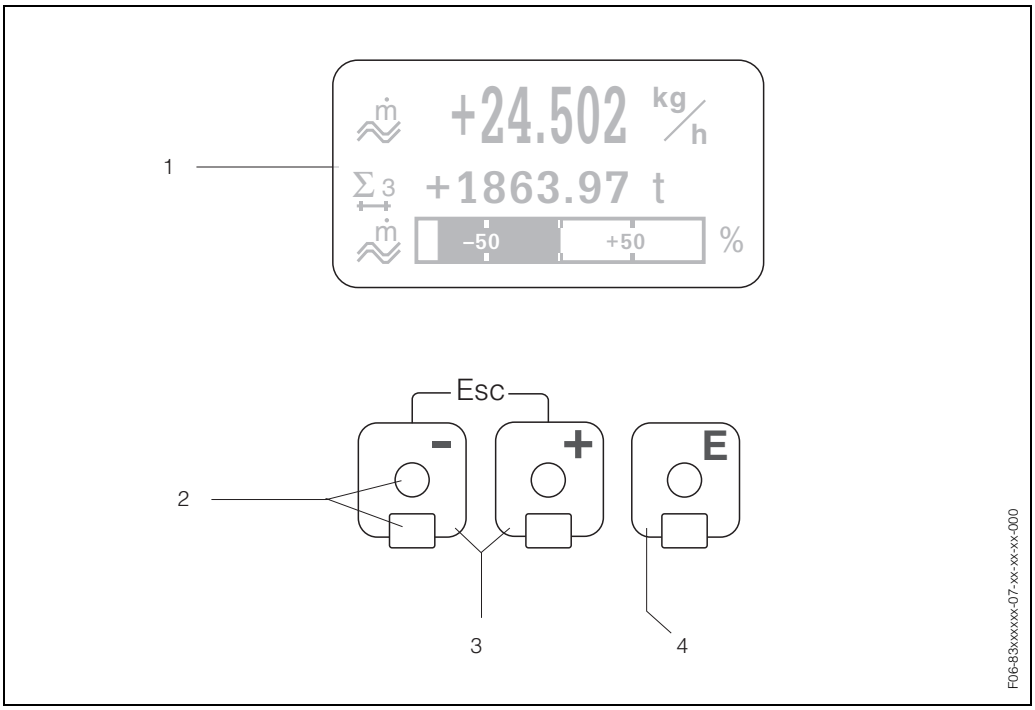


Fig. 22: Display and operating elements

Liquid crystal display (1)
The backlit, four-line liquid crystal display shows measured values, dialogue texts, fault messages and notice messages. The display as it appears when normal measuring is in progress is known as the HOME position (operating mode). Readings displayed → Page 36

Optical sensors for Touch Control (2)

Plus/minus keys (3)
– *HOME position → Direct access to totalizer values and actual values of inputs/outputs*
– *Enter numerical values, select parameters*
– *Select different blocks, groups and function groups within the function matrix*

Press the +/– keys ( ) simultaneously to trigger the following functions:
– *Exit the function matrix step by step → HOME position*
– *Press and hold down +/– keys for longer than 3 seconds → Return directly to HOME position*
– *Cancel data entry*

Enter key (4)
– *HOME position → Entry into the function matrix*
– *Save the numerical values you input or settings you change*

Readings displayed (operation mode)
The display area consists of three lines in all; this is where measured values are displayed, and/or status variables (direction of flow, bar graph, etc.). You can change the assignment of display lines to different variables to suit your needs and preferences (→ see the "Description of Device Functions" manual).

Multiplex mode:
A maximum of two different display variables can be assigned to each line. Variables multiplexed in this way alternate every 10 seconds on the display.

Error messages:
The modes of presentation for system and process error messages are described in detail on Page 42 ff.

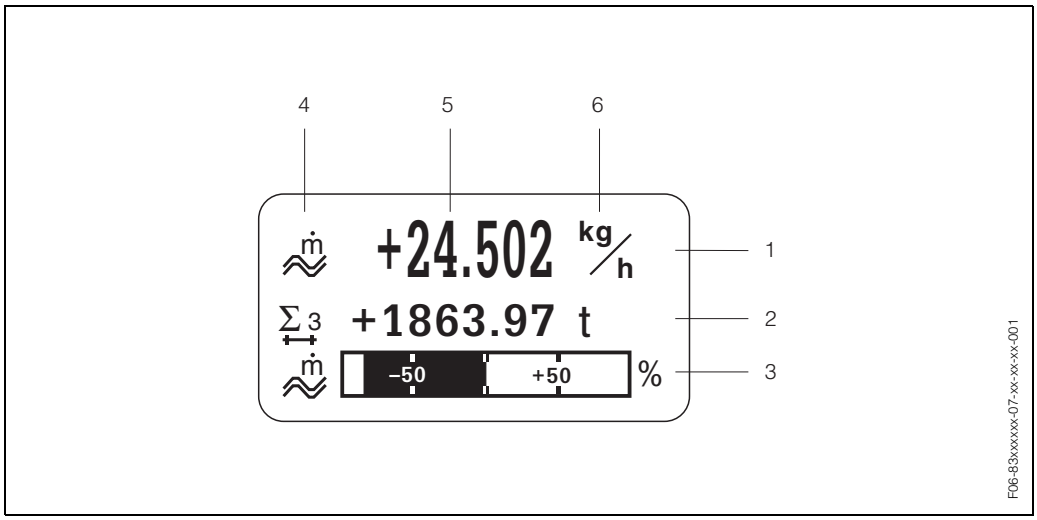


Fig. 23: Typical display for normal operating mode (HOME position)

1 Main display line: shows primary measured values, e.g. mass flow in [kg/h].
2 Additional line: shows measured variables and status variables, e.g. totalizer No. 3 in [t].
3 Information line: shows additional information on the measured variables and status variables, e.g. bar graph of the limit value achieved by the mass flow.
4 "Info icons" field: Icons representing additional information on the measured values are shown in this field. For a full list of the icons and their meanings → Page 37
5 "Measured values" field: The current measured values appear in this field.
6 "Unit of measure" field: The units of measure and time defined for the current measured values appear in this field.

Additional display functions
Depending on the order options, the local display has different display functions:

Device without batching software:
From HOME position, use the +/– keys to open an "Info Menu" containing the following information:
- Totalizer (including overflow)
- Actual values or states of the configured inputs/outputs
- Device TAG number (user-definable)

[+][–] → Scan of individual values within the Info Menu
[–][+] (Esc key) → Back to HOME position

Device with batching software:
On measuring instruments with installed batching software (F-Chip, see Page 87) and a suitably configured display line, you can carry out filling processes directly using the local display. You will find a detailed description on → Page 39.

Icons
The icons which appear in the field on the left make it easier to read and recognise measured variables, device status, and error messages.

Icon	Meaning	Icon	Meaning
S	System error	P	Process error
ϟ	Fault message (with effect on outputs)	!	Notice message (without effect on outputs)
| 1...n	Current output 1...n or Current input	P 1...n	Pulse output 1...n
F 1...n	Frequency output 1...n	S 1...n	Status/relay output 1...n (or status input)
Σ 1...n	Summenzähler 1...n		
	Measuring mode; PULSATING FLOW		Measuring mode; SYMMETRY (bidirectional)
	Measuring mode; STANDARD		Counting mode, totalizer; BALANCE (forward and reverse flow)
	Counting mode, totalizer; forward		Counting mode, totalizer; reverse
	Status input		Volume flow
	Target volume flow		Target corrected volume flow
	Carrier volume flow		Carrier corrected volume flow
	% Target volume flow		% Target corrected volume flow
	Mass flow		Target mass flow
	% Target mass flow		Carrier mass flow
	% Carrier mass flow		Fluid density

Icon	Meaning	Icon	Meaning
	Reference density		Current input
	Batching quantity upwards		Batching quantity downwards
	Batching quantity		Total batching quantity
	Batch counter (x times)		Fluid temperature
	Remote configuration Active device operation via: • HART, e.g. FieldTool, DXR 375 • FOUNDATION Fieldbus • PROFIBUS, e.g. Commuwin II		

Controlling the batching processes using the local display
With measuring instruments with suitable software, you can carry out batching processes directly using the local display. Therefore, the Promass 83 can be fully deployed in the field as a "batch controller".

Procedure:

1. Configure all the required batching functions and assign the lower display info line (= BATCHING KEYS) using the "Batch" Quick Setup menu or use the function matrix. The following "softkeys" then appear on the bottom line of the local display (Fig. 24):
   – START = left display key (–)
   – PRESET = middle display key (+)
   – MATRIX = right display key (E)
2. Press the "PRESET (+)" key. Various batching process functions requiring configuration will now appear on the display:

"PRESET" → Initial settings for the batching process		
No.	Function	Settings
7200	BATCH SELECTOR	[+][–] → Selection of the batching liquid (BATCH #1...6)
7203	BATCH QUANTITY	If the "ACCESS CUSTOMER" option was selected for the "PRESET batch quantity" prompt in the "Batching" Quick Setup, the batching quantity can be altered via the local display. If the "LOCKED" option was selected, the batching quantity can only be read and cannot be altered until the private code has been entered.
7265	RESET TOTAL BATCH SUM/COUNTER	Resets the batching quantity counter or the total batching quantity to "0".

3. After exiting the PRESET menu, you can now start the batching process by pressing "START (–)". New softkeys (STOP / HOLD or GO ON) now appear on the display. You can use these to interrupt, continue or stop the batching process at any time (Fig. 24):

   STOP (–) → Stop batching process
   HOLD (+) → Interrupts batching process (softkey changes to "GO ON")
   GO ON (+) → Continues batching process (softkey changes to "HOLD")

   After the batch quantity is reached, the "START" or "PRESET" softkeys reappear on the display.

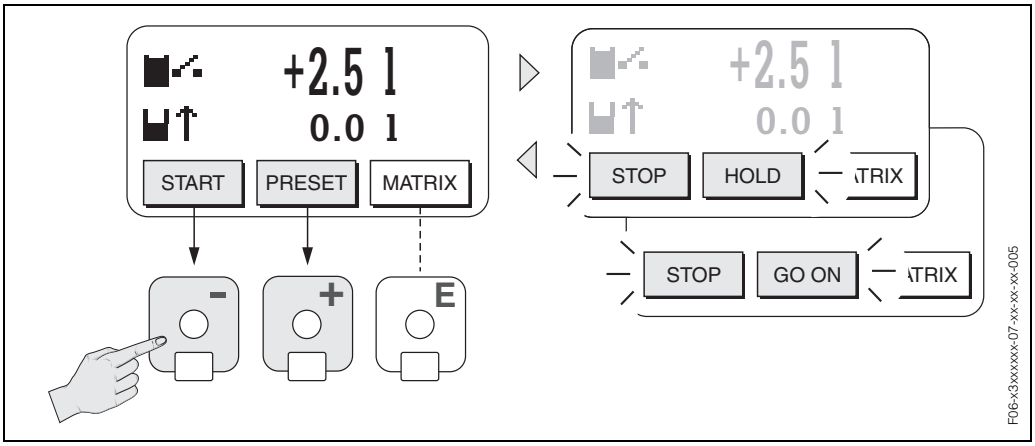


Fig. 24: Controlling batching processes using the local display (softkeys)

5.2 Brief operating instructions to the function matrix

Note:
- See the general notes on Page 41.
- Function descriptions → see the “Description of Device Functions” manual

1. HOME position → E → Enter the function matrix
2. Select a block (e.g. OUTPUTS)
3. Select a group (e.g. CURRENT OUTPUT 1)
4. Select a function group (e.g. SETTINGS)
5. Select a function (e.g. TIME CONSTANT)

   Change parameter / enter numerical values:
   +/− → select or enter: enable code, parameters, numerical values
   E → save your entries

6. Exit the function matrix:
   – Press and hold down Esc key (−/+) for longer than 3 seconds → HOME position
   – Repeatedly press Esc key (−/+) → return step by step to HOME position

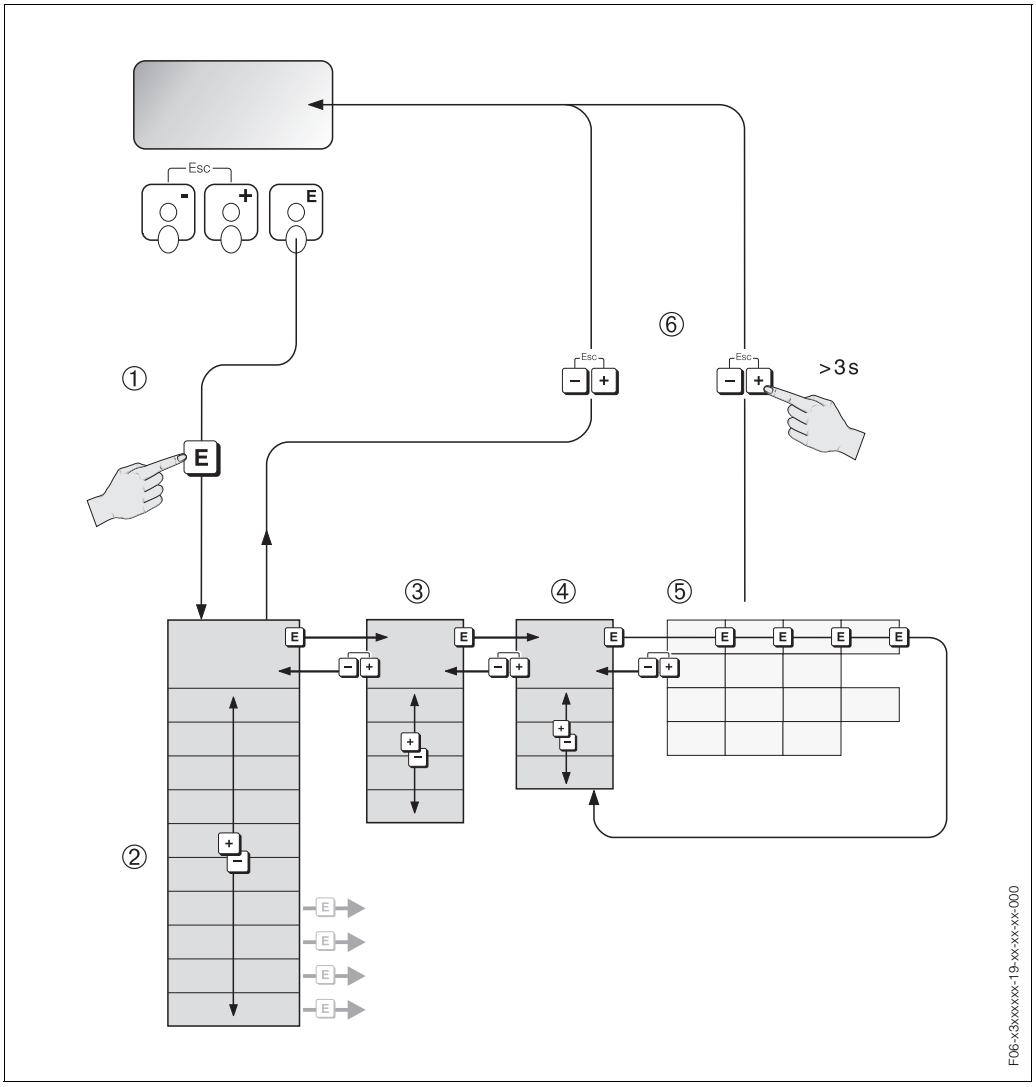


Fig. 25: Selecting functions and configuring parameters (function matrix)

General notes
The Quick Setup menu (see Page 60) contains the default settings that are adequate for commissioning.
Complex measuring operations on the other hand necessitate additional functions that you can configure as necessary and customise to suit your process parameters. The function matrix, therefore, comprises a multiplicity of additional functions which, for the sake of clarity, are arranged on a number of menu levels (blocks, groups, and function groups).

Comply with the following instructions when configuring functions:
- You select functions as described on Page 40. Each cell in the function matrix is identified by a numerical or letter code on the display.
- You can switch off certain functions (OFF). If you do so, related functions in other function groups will no longer be displayed.
- Certain functions prompt you to confirm your data entries. Press ⊞ to select "SURE [YES]" and press ℡ again to confirm. This saves your setting or starts a function, as applicable.
- Return to the HOME position is automatic if no key is pressed for 5 minutes.

Note:
- The transmitter continues to measure while data entry is in progress, i.e. the currently measured values are output via the signal outputs in the normal way.
- If the power supply fails all preset and parameterised values remain safely stored in the EEPROM.

Caution:
All functions are described in detail, as is the function matrix itself, in the **"Description of Device Functions"** manual, which is a separate part of these Operating Instructions.

Enabling the programming mode
The function matrix can be disabled. Disabling the function matrix rules out the possibility of inadvertent changes to device functions, numerical values or factory settings. A numerical code (factory setting = 83) has to be entered before settings can be changed.
If you use a code number of your choice, you exclude the possibility of unauthorised persons accessing data (→ see the "Description of Device Functions" manual).

Comply with the following instructions when entering codes:
- If programming is disabled and the ⊞ keys are pressed in any function, a prompt for the code automatically appears on the display.
- If "0" is entered as the customer's code, programming is always enabled.
- The E+H service organisation can be of assistance if you mislay your personal code.

Caution:
Changing certain parameters such as all sensor characteristics, for example, influences numerous functions of the entire measuring system, particularly measuring accuracy. There is no need to change these parameters under normal circumstances and consequently, they are protected by a special code known only to the E+H service organisation. Please contact Endress+Hauser if you have any questions.

Disabling the programming mode
Programming mode is disabled if you do not press a key within 60 seconds following automatic return to the HOME position.
You can also disable programming in the “ACCESS CODE” function by entering any number (other than the customer's code).

5.3 Error messages

Type of error
Errors that occur during commissioning or measuring are displayed immediately. If two or more system or process errors occur, the error with the highest priority is the one shown on the display.

The measuring system distinguishes between two types of error:
- *System error:* This group includes all device errors, e.g. communication errors, hardware errors, etc. → Page 90
- *Process error:* This group includes all application errors, e.g. fluid not homogeneous, etc. → Page 98

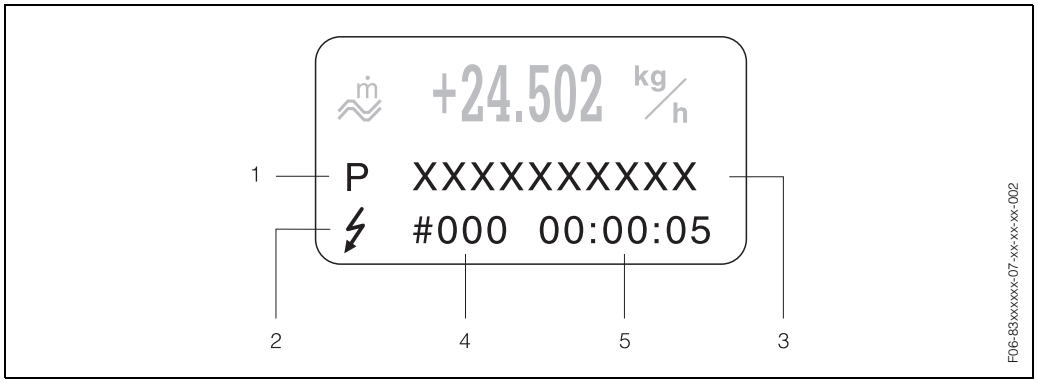


Fig. 26: Error messages on the display (example)

1 Error type: P = process error, S = system error
2 Error message type: ϟ = fault message, ! = notice message
3 Error designation: e.g. FLUID INHOM. = fluid is not homogeneous
4 Error number: e.g. # 702
5 Duration of most recent error occurrence (in hours, minutes and seconds)

Error message type
Users have the option of weighting system and process errors differently, by defining them as **“Fault messages”** or **“Notice messages”**. You can define messages in this way with the aid of the function matrix (see the “Description of Device Functions” manual).
Serious system errors, e.g. module defects, are always identified and classed as “fault messages” by the measuring device.

Notice message (!)
- Displayed as → Exclamation mark (!), error designation (S: system error, P: process error).
- The error in question has no effect on the outputs of the measuring device.

Fault message (ϟ)
- Displayed as → Lightning flash *(ϟ),* error designation (S: system error, P: process error).
- The error in question has a direct effect on the outputs.
  The response of the outputs (failsafe mode) can be defined by means of functions in the function matrix (see Page 101).

Note:
- Error conditions can be output via the relay outputs
- If an error message occurs, an upper or lower signal level for the breakdown information according to NAMUR 43 can be output via the current output.

Confirming error messages
For the sake of plant and process safety, the measuring device can be configured in such a way that fault messages (ϟ) always have to be rectified and acknowledged locally by pressing E . Only then do the error messages disappear from the display. This option can be switched on or off by means of the "ACKNOWLEDGE FAULT MESSAGES" function (see the "Description of Device Functions" manual).

Note:
- Fault messages (ϟ) can also be reset and confirmed via the status input.
- Notice messages (!) do not require acknowledgment. Note, however, that they remain visible until the cause of the error has been rectified.

5.4 Communication (HART)

In addition to local operation, the measuring device can be configured and measured values can be obtained by means of the HART protocol. Digital communication takes place using the 4–20 mA current output HART (see Page 31).

The HART protocol allows the transfer of measuring and device data between the HART master and the field devices for configuration and diagnostics purposes. The HART master, e.g. a handheld terminal or PC-based operating programs (such as FieldTool), require device description (DD) files which are used to access all the information in a HART device.
Information is exclusively transferred using so-called "commands". There are three different command groupes:

Universal commands:
All HART device support and use universal commands. The following functionalities are linked to them:
- Recognizing HART devices
- Reading digital measured values (volume flow, totalizer, etc.)

Common practice commands:
Common practice commands offer functions which are supported and can be executed by most but not all field devices.

Device-specific commands:
These commands allow access to device-specific functions which are not HART standard. Such commands access individual field device information, amongst other things, such as empty/full pipe calibration values, creepage settings, etc.

Note!
Promass 83 has access to all three command classes. On Page 46, you will find a list with all the supported "Universal Commands" and "Common Practice Commands".

5.4.1 Operating options

For the complete operation of the measuring device, including device-specific commands, there are DD files available to the user to provide the following operating aids and programs:

HART Communicator DXR 375
Selecting device functions with a HART Communicator is a process involving a number of menu levels and a special HART function matrix. The HART manual in the carrying case of the HART Communicator contains more detailed information on the device.

FieldTool operating program
FieldTool is a universal service and configuration software package designed for the PROline measuring devices. Connection is by means of a HART-Modem, e.g. Commubox FXA 191.

The functionality of FieldTool includes the following:
- Configuration of device functions
- Visualization of measuring values (including data logging)
- Data backup of device parameters
- Advanced device diagnosis
- Measuring-point documentation

You can find more information on FieldTool in the following E+H document:
System Information: SI 031D/06/en “FieldTool”

Other operating programs
- Operating program “AMS” (Fisher Rosemount)
- Operating program “SIMATIC PDM” (Siemens)

Note:
- The HART protocol requires the “4…20 mA setting (individual options see device function) in the CURRENT SPAN function (current output 1).
- HART write protection can be disabled or enabled by means of a jumper on the I/O board → Page 57.

5.4.2 Device and process variables

Device variables:
The following device variables are available using the HART protocol:

Code (decimal)	Device variable
0	OFF (unassigned)
2	Mass flow
5	Volume flow
6	Corrected volume flow
7	Density
8	Reference density
9	Temperature
250	Totalizer 1
251	Totalizer 2
252	Totalizer 3

Process variables:
At the factory, the process variables are assigned to the following device variables:

- Primary process variable (PV) → Mass flow
- Second process variable (SV) → Totalizer 1
- Third process variable (TV) → Density
- Fourth process variable (FV) → Temperature

Note!
You can set or change the assignment of device variables to process variables using Command 51 (see Page 51).

5.4.3 Universal / Common practice HART commands

The following table contains all the universal and common practice commands supported by Promass 83.

Command No. **HART command / Access type**		**Command data** (numeric data in decimal form)	**Response data** (numeric data in decimal form)
Universal Commands			
0	Read unique device identifier Access type = read	none	Device identification delivers information on the device and the manufacturer. It cannot be changed. The response consists of a 12 byte device ID: – Byte 0: fixed value 254 – Byte 1: Manufacturer ID, 17 = E+H – Byte 2: Device type ID, 81 = Promass 83 – Byte 3: Number of preambles – Byte 4: Universal commands rev. no. – Byte 5: Device-specific commands rev. no. – Byte 6: Software revision – Byte 7: Hardware revision – Byte 8: Additional device information – Bytes 9-11: Device identification
1	Read primary process variable Access type = read	none	– Byte 0: HART unit code of the primary process variable – Bytes 1-4: Primary process variable *Factory setting:* Primary process variable = Mass flow ✎ Note! • You can set the assignment of device variables to process variables using Command 51. • Manufacturer-specific units are represented using the HART unit code “240”.
2	Read the primary process variable as current in mA and percentage of the set measuring range Access type = read	none	– Bytes 0-3: actual current of the primary process variable in mA – Bytes 4-7: Percentage of the set measuring range *Factory setting:* Primary process variable = Mass flow ✎ Note! You can set the assignment of device variables to process variables using Command 51.

Command No. **HART command / Access type**		**Command data** (numeric data in decimal form)	**Response data** (numeric data in decimal form)
3	Read the primary process variable as current in mA and four (preset using Command 51) dynamic process variables Access type = read	none	24 bytes are sent as a response: – Bytes 0-3: primary process variable current in mA – Byte 4: HART unit code of the primary process variable – Bytes 5-8: Primary process variable – Byte 9: HART unit code of the second process variable – Bytes 10-13: Second process variable – Byte 14: HART unit code of the third process variable – Bytes 15-18: Third process variable – Byte 19: HART unit code of the fourth process variable – Bytes 20-23: Fourth process variable *Factory setting:* • Primary process variable = Mass flow • Second process variable = Totalizer 1 • Third process variable = Density • Fourth process variable = Temperature ✎ Note! • You can set the assignment of device variables to process variables using Command 51. • Manufacturer-specific units are represented using the HART unit code “240”.
6	Set HART shortform address Access type = write	Byte 0: desired address (0...15) *Factory setting:* 0 ✎ Note! With an address >0 (multidrop mode), the current output of the primary process variable is set to 4 mA.	Byte 0: active address
11	Read unique device identification using the TAG (measuring point designation) Access type = read	Bytes 0-5: TAG	Device identification delivers information on the device and the manufacturer. It cannot be changed. The response consists of a 12 byte device ID if the given TAG agrees with the one saved in the device: – Byte 0: fixed value 254 – Byte 1: Manufacturer ID, 17 = E+H – Byte 2: Device type ID, 81 = Promass 83 – Byte 3: Number of preambles – Byte 4: Universal commands rev. no. – Byte 5: Device-specific commands rev. no. – Byte 6: Software revision – Byte 7: Hardware revision – Byte 8: Additional device information – Bytes 9-11: Device identification
12	Read user message Access type = read	none	Bytes 0-24: User message ✎ Note! You can write the user message using Command 17.

Command No. **HART command / Access type**		**Command data** (numeric data in decimal form)	**Response data** (numeric data in decimal form)
13	Read TAG, descriptor and date Access type = read	none	– Bytes 0-5: TAG – Bytes 6-17: descriptor – Bytes 18-20: Date ✎ Note! You can write the TAG, descriptor and date using Command 18.
14	Read sensor information on primary process variable	none	– Bytes 0-2: Sensor serial number – Byte 3: HART unit code of sensor limits and measuring range of the primary process variable – Bytes 4-7: Upper sensor limit – Bytes 8-11: Lower sensor limit – Bytes 12-15: Minimum span ✎ Note! • The data relate to the primary process variable (= Mass flow). • Manufacturer-specific units are represented using the HART unit code “240”.
15	Read output information of primary process variable Access type = read	none	– Byte 0: Alarm selection ID – Byte 1: Transfer function ID – Byte 2: HART unit code for the set measuring range of the primary process variable – Bytes 3-6: End of measuring range, value for 20 mA – Bytes 7-10: Start of measuring range, value for 4 mA – Bytes 11-14: Attenuation constant in [s] – Byte 15: Write protection ID – Byte 16: OEM dealer ID, 17 = E+H *Factory setting:* Primary process variable = Mass flow ✎ Note! • You can set the assignment of device variables to process variables using Command 51. • Manufacturer-specific units are represented using the HART unit code “240”.
16	Read the device production number Access type = read	none	Bytes 0-2: Production number
17	Write user message Access = write	You can save any 32-character long text in the device under this parameter: Bytes 0-23: Desired user message	Displays the current user message in the device: Bytes 0-23: Current user message in the device

Command No. **HART command / Access type**		**Command data** (numeric data in decimal form)	**Response data** (numeric data in decimal form)
18	Write TAG, descriptor and date Access = write	With this parameter, you can store an 8 character TAG, a 16 character descriptor and a date: – Bytes 0-5: TAG – Bytes 6-17: descriptor – Bytes 18-20: Date	Displays the current information in the device: – Bytes 0-5: TAG – Bytes 6-17: descriptor – Bytes 18-20: Date
Common Practice Commands			
34	Write damping value for primary process variable Access = write	Bytes 0-3: Damping value of the primary process variable in seconds *Factory setting:* Primary process variable = Mass flow	Displays the current damping value in the device: Bytes 0-3: Damping value in seconds
35	Write measuring range of primary process variable Access = write	Write the desired measuring range: – Byte 0: HART unit code of the primary process variable – Bytes 1-4: upper range, value for 20 mA – Bytes 5-8: lower range, value for 4 mA *Factory setting:* Primary process variable = Mass flow ✎ Note! • You can set the assignment of device variables to process variables using Command 51. • If the HART unit code is not the correct one for the process variable, the device will continue with the last valid unit.	The currently set measuring range is displayed as a response: – Byte 0: HART unit code for the set measuring range of the primary process variable – Bytes 1-4: upper range, value for 20 mA – Bytes 5-8: lower range, value for 4 mA ✎ Note! Manufacturer-specific units are represented using the HART unit code “240”.
38	Device status reset (Configuration changed) Access = write	none	none
40	Simulate output current of primary process variable Access = write	Simulation of the desired output current of the primary process variable. An entry value of 0 exits the simulation mode: Bytes 0-3: Output current in mA *Factory setting:* Primary process variable = Mass flow ✎ Note! You can set the assignment of device variables to process variables using Command 51.	The momentary output current of the primary process variable is displayed as a response: Bytes 0-3: Output current in mA
42	Perform master reset Access = write	none	none

Command No. **HART command / Access type**		**Command data** (numeric data in decimal form)	**Response data** (numeric data in decimal form)
44	Write unit of primary process variable Access = write	Set unit of primary process variable. Only unit which are suitable for the process variable are transferred to the device: Byte 0: HART unit code *Factory setting:* Primary process variable = Mass flow ✎ Note! • If the written HART unit code is not the correct one for the process variable, the device will continue with the last valid unit. • If you change the unit of the primary process variable, this has no impact on the system units.	The current unit code of the primary process variable is displayed as a response: Byte 0: HART unit code ✎ Note! Manufacturer-specific units are represented using the HART unit code “240”.
48	Read additional device status Access = read	none	The device status is displayed in extended form as the response: Coding: see table on Page 52
50	Read assignment of the device variables to the four process variables Access = read	none	Display of the current variable assignment of the process variables: – Byte 0: Device variable code to the primary process variable – Byte 1: Device variable code to the second process variable – Byte 2: Device variable code to the third process variable – Byte 3: Device variable code to the fourth process variable *Factory setting:* • Primary process variable: Code 1 for mass flow • Second process variable: Code 250 for totalizer 1 • Third process variable: Code 2 for density • Fourth process variable: Code 0 for temperature ✎ Note! You can set or change the assignment of device variables to process variables using Command 51.

Command No. **HART command / Access type**		**Command data** (numeric data in decimal form)	**Response data** (numeric data in decimal form)
51	Write assignments of the device variables to the four process variables Access = write	Setting of the device variables to the four process variables: – Byte 0: Device variable code to the primary process variable – Byte 1: Device variable code to the second process variable – Byte 2: Device variable code to the third process variable – Byte 3: Device variable code to the fourth process variable *Code of the supported device variables:* See data on Page 45 *Factory setting:* • Primary process variable = Mass flow • Second process variable = Totalizer 1 • Third process variable = Density • Fourth process variable = Temperature	The variable assignment of the process variables is displayed as a response: – Byte 0: Device variable code to the primary process variable – Byte 1: Device variable code to the second process variable – Byte 2: Device variable code to the third process variable – Byte 3: Device variable code to the fourth process variable
53	Write device variable unit Access = write	This command set the unit of the given device variables. Only those units which suit the device variable are transferred: – Byte 0: Device variable code – Byte 1: HART unit code *Code of the supported device variables:* See data on Page 45 ✎ Note! • If the written unit is not the correct one for the device variable, the device will continue with the last valid unit. • If you change the unit of the device variable, this has no impact on the system units.	The current unit of the device variables is displayed in the device as a response: – Byte 0: Device variable code – Byte 1: HART unit code ✎ Note! Manufacturer-specific units are represented using the HART unit code “240”.
59	Write number of preambles in response message Access = write	This parameter sets the number of preambles which are inserted in the response messages: Byte 0: Number of preambles (2...20)	As a response, the current number of the preambles is displayed in the response message: Byte 0: Number of preambles

5.4.4 Device status / Error messages

You can read the extended device status, in this case, current error messages, via Command “48”. The command delivers information which are partly coded in bits (see table below).

✎ Note!
You can find a detailed explanation of the device status and error messages and their elimination on Page 90 ff.

Byte	Bit	Error No.	Short error description (→ Page 90 ff.)
0	0	001	Serious device error
	1	011	Measuring amplifier has faulty EEPROM
	2	012	Error when accessing data of the measuring amplifier EEPROM
	3	not assigned	–
	4	not assigned	–
	5	not assigned	–
	6	not assigned	–
	7	not assigned	–
1	0	not assigned	–
	1	031	S-DAT: defective or missing
	2	032	S-DAT: Error accessing saved values
	3	041	T-DAT: defective or missing
	4	042	T-DAT: Error accessing saved values
	5	051	I/O board and the amplifier board are not compatible.
	6	not assigned	–
	7	not assigned	–
2	0	not assigned	–
	1	not assigned	–
	2	not assigned	–
	3	not assigned	–
	4	not assigned	–
	5	not assigned	–
	6	not assigned	–
	7	not assigned	–
3	0	not assigned	–
	1	not assigned	–
	2	not assigned	–
	3	111	Totalizer checksum error
	4	121	I/O board and the amplifier board (software versions) are not compatible.
	5	not assigned	–
	6	205	T-DAT: Data download not successful
	7	206	T-DAT: Data upload not successful

Byte	Bit	Error No.	Short error description (→ Page 90 ff.)
4	0	not assigned	–
	1	not assigned	–
	2	not assigned	–
	3	251	Internal communication fault on the amplifier board.
	4	261	No data reception between amplifier and I/O board
	5	not assigned	–
	6	not assigned	–
	7	not assigned	–
5	0	not assigned	–
	1	not assigned	–
	2	not assigned	–
	3	not assigned	–
	4	not assigned	–
	5	not assigned	–
	6	not assigned	–
	7	339	Flow buffer: The temporarily buffered flow portions (measuring mode for pulsating flow) could not be cleared or output within 60 seconds.
6	0	340	
	1	341	
	2	342	
	3	343	Frequency buffer: The temporarily buffered flow portions (measuring mode for pulsating flow) could not be cleared or output within 60 seconds.
	4	344	
	5	345	
	6	346	
	7	347	Pulse buffer: The temporarily buffered flow portions (measuring mode for pulsating flow) could not be cleared or output within 60 seconds.
7	0	348	
	1	349	
	2	350	
	3	351	Current output: flow is out of range.
	4	352	
	5	353	
	6	354	
	7	355	Frequency output: flow is out of range.
8	0	356	
	1	357	
	2	358	
	3	359	Pulse output: the pulse output frequency is out of range.
	4	360	
	5	361	
	6	362	
	7	not assigned	–

Byte	Bit	Error No.	Short error description (→ Page 90 ff.)
9	0	379	The measuring tube oscillation frequency is outside the permitted range.
	1	380	
	2	381	The temperature sensor on the measuring tube is likely defective.
	3	382	The temperature sensor on the measuring tube is likely defective.
	4	383	The temperature sensor on the carrier tube is likely defective.
	5	384	
	6	385	One of the measuring tube exciter coils (inlet or outlet) is likely defective.
	7	386	
10	0	387	
	1	388	Amplifier error
	2	389	
	3	390	
	4	not assigned	–
	5	not assigned	–
	6	not assigned	–
	7	not assigned	–
11	0	not assigned	–
	1	not assigned	–
	2	not assigned	–
	3	not assigned	–
	4	not assigned	–
	5	not assigned	–
	6	471	Max. permitted batching time has been exceeded.
	7	472	Underbatching: the minimum quantity was not reached. Overbatching: the maximum permitted batching quantity was exceeded.
12	0	473	The predefined batch quantity point was exceeded. End of filling process approaching.
	1	not assigned	–
	2	not assigned	–
	3	not assigned	–
	4	not assigned	–
	5	not assigned	–
	6	not assigned	–
	7	501	New amplifier software version is loaded. Currently no other commands are possible.

Byte	Bit	Error No.	Short error description (→ Page 90 ff.)
13	0	not assigned	–
	1	not assigned	–
	2	571	Batching process in progress (valves are open)
	3	572	Batching process has been stopped (valves are closed)
	4	not assigned	–
	5	586	The fluid properties do not allow a continuation of the measurement.
	6	587	Extreme process conditions exist. The measuring system can therefore not be started.
	7	588	Overdriving of the internal analog to digital converter. A continuation of the measurement is no longer possible!
14	0	not assigned	–
	1	not assigned	–
	2	not assigned	–
	3	601	Positive zero return active
	4	not assigned	–
	5	not assigned	–
	6	not assigned	–
	7	611	Simulation current output active
15	0	612	
	1	613	
	2	614	
	3	621	Simulation frequency output active
	4	622	
	5	623	
	6	624	
	7	631	Simulation pulse output active
16	0	632	
	1	633	
	2	634	
	3	641	Simulation status output active
	4	642	
	5	643	
	6	644	
	7	651	Simulation relay output active

Byte	Bit	Error No.	Short error description (→ Page 90 ff.)
17	0	652	Simulation relay output active
	1	653	Simulation relay output active
	2	654	Simulation relay output active
	3	661	Simulation current input active
	4	not assigned	–
	5	not assigned	–
	6	not assigned	–
	7	671	Simulation status input active
18	0	672	
	1	673	
	2	674	
	3	691	Simulation of response to error (outputs) active
	4	692	Simulation of volume flow active
	5	not assigned	–
	6	not assigned	–
	7	not assigned	–
19	0	700	The process fluid density is outside the upper or lower limit values set in the “EPD” function
	1	701	The maximum current value for the measuring tube exciter coils has been reached, since certain process fluid characteristics are extreme.
	2	702	Frequency control is not stable, due to inhomogeneous fluid.
	3	703	NOISE LIM. CH0 Overdriving of the internal analog to digital converter. A continuation of the measurement is still possible!
	4	704	NOISE LIM. CH1 Overdriving of the internal analog to digital converter. A continuation of the measurement is still possible!
	5	705	The electronics' measuring range will be exceeded. The mass flow is too high.
	6	not assigned	–
	7	not assigned	–
20	0	not assigned	–
	1	not assigned	–
	2	not assigned	–
	3	not assigned	–
	4	not assigned	–
	5	731	The zero point adjustment is not possible or has been cancelled.
	6	not assigned	–
	7	not assigned	–
24	5	363	Current input: The actual value for the current lies outside the set limits.

5.4.5 Switching HART write protection on and off

A jumper on the I/O board provides the means of switching HART write protection on or off.

Warning:
Risk of electric shock. Exposed components carry dangerous voltages. Make sure that the power supply is switched off before you remove the cover of the electronics compartment.

1. Switch off power supply.
2. Remove the I/O board → see Page 104, 106
3. Switch HART write protection on or off, as applicable, by means of the jumper (Fig. 27).
4. Installation of the I/O board is the reverse of the removal procedure.

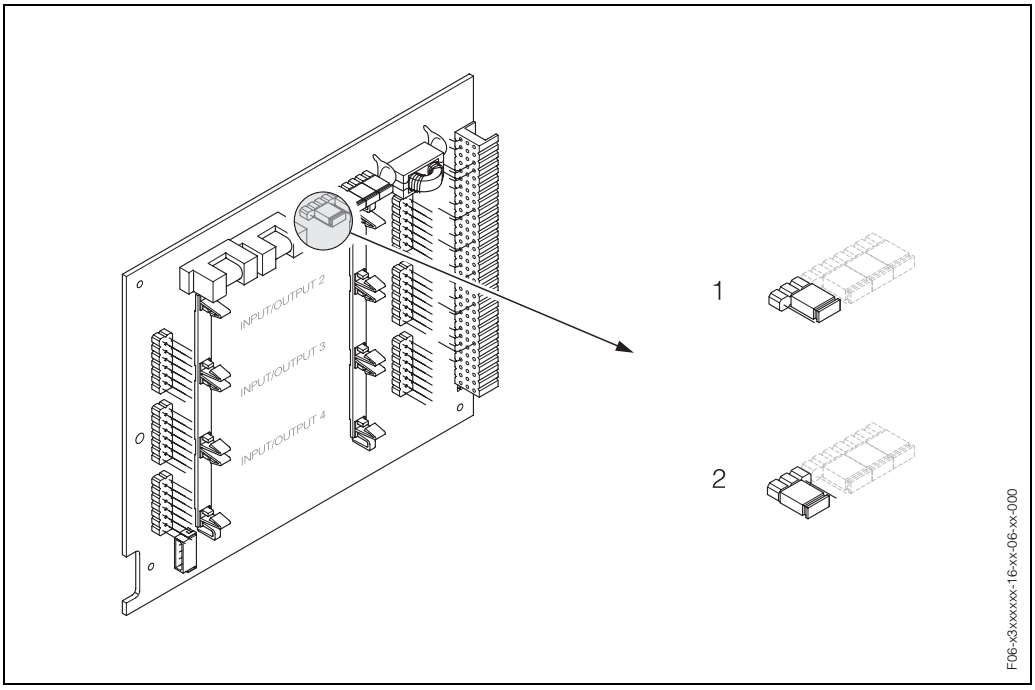


Fig. 27: Switching HART write protection on and off (I/O board)

1 Write protection OFF (default), that is: HART protocol unlocked
2 Write protection ON, that is: HART protocol locked

6 Commissioning

6.1 Function check

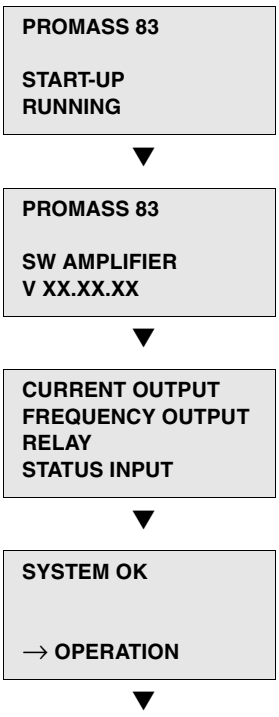
Make sure that all final checks have been completed before you start up your measuring point:
- Checklist for “Post installation check” → Page 23
- Checklist for “Post connection check” → Page 33

6.2 Commissioning

In the case of measuring devices without a local display, the individual parameters and functions must be configured via the configuration program, e.g. FieldTool.
If the measuring device is equipped with a local display, all the important device parameters for standard operation can be configured quickly and easily by means of the “Commissioning” Quick Setup menu.
- Quick Setup “Commissioning”, → Page 60
- Quick Setup “Pulsating flow”, → Page 62
- Quick Setup “Batching”, → Page 65
- Quick Setup “Gas measurement”, → Page 69

6.2.1 Switching on the measuring device

Once the function checks have been successfully completed, it is time to switch on the power supply. The device is now operational.
The measuring device performs a number of power on self-tests. As this procedure progresses the following sequence of messages appears on the local display:



Start-up message

Current software version

List of installed input/output modules

Beginning of normal measuring mode

Normal measuring mode commences as soon as start-up completes. Various measured value and/or status variables appear on the display (HOME position).

✎ Note:
If start-up fails, an error message indicating the cause is displayed.

6.2.2 Quick Setup "Commissioning"

This Quick Setup menu guides you systematically through the setup procedure for all the major device functions that have to be configured for standard measuring operation.

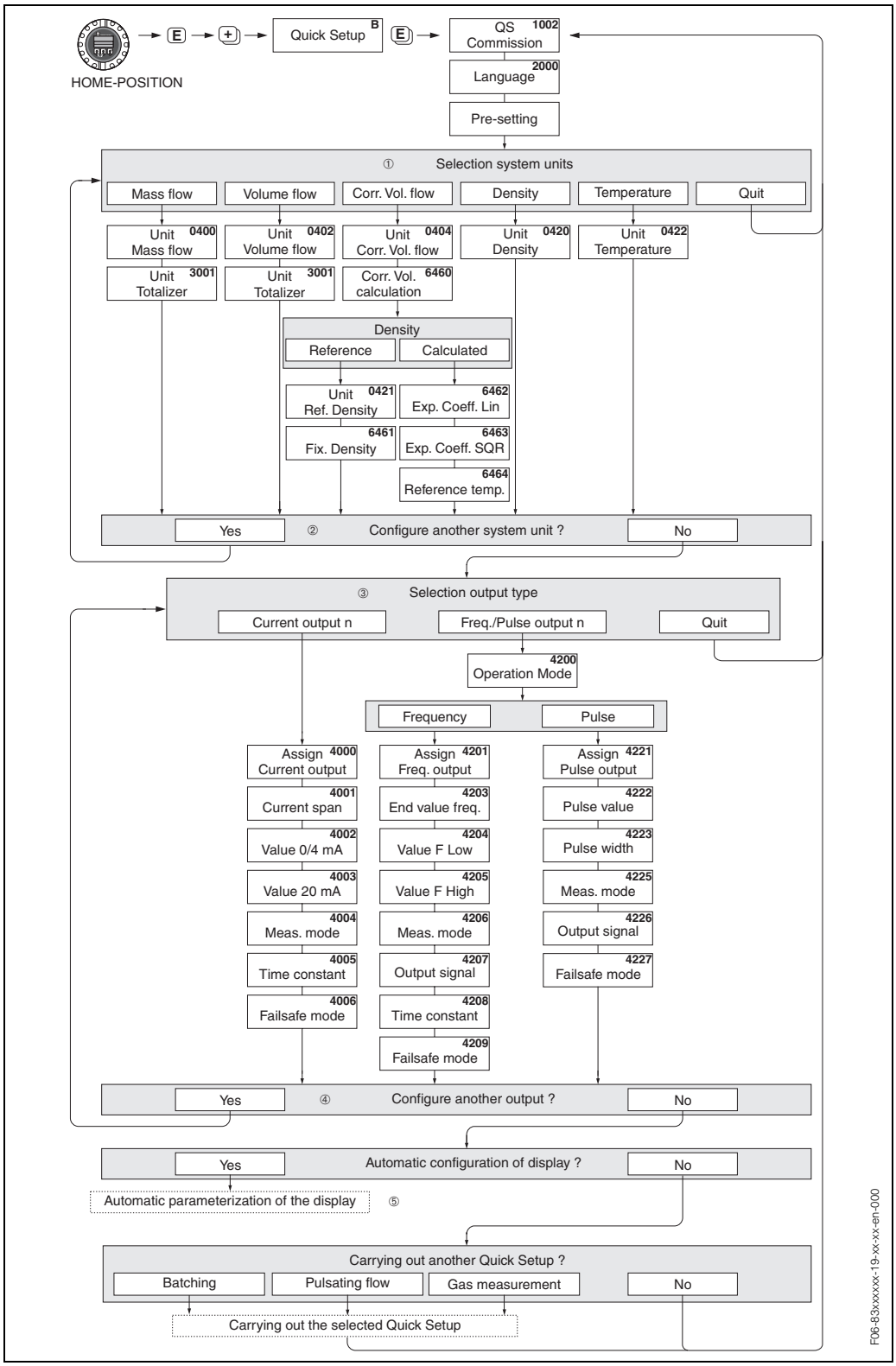


Fig. 28: Quick Setup menu for straightforward configuration of the major device functions

Information on the points numbered in the Quick Setup can be found on the following page.

Note:
- The display returns to the cell QUICK SETUP COMMISSION (1002) if you press the ESC key combination during parameter interrogation. The stored parameters remain valid.
- The “Commissioning” Quick Setup must be carried out before one of the Quick Setups explained below is run.

- ① Only units not yet configured in the current Setup are offered for selection in each cycle. The unit for mass, volume and corrected volume is derived from the corresponding flow unit.

- ② The “YES” option remains visible until all the units have been configured. “NO” is the only option displayed when no further units are available.

- ③ Only the outputs not yet configured in the current Setup are offered for selection in each cycle.

- ④ The “YES” option remains visible until all the outputs have been parameterized. “NO” is the only option displayed when no further outputs are available.

- ⑤ The “automatic parameterization of the display” option contains the following basic settings/factory settings:
  YES: Main line = Mass flow; Additional line = Totalizer 1; Information line = Operating/system conditions.
  NO: The existing (selected) settings remain.

6.2.3 Quick Setup “Pulsating Flow”

Certain types of pump such as reciprocating, peristaltic and cam-type pumps, for example, create a flow characterised by severe periodic fluctuations (Fig. 29). Negative flows can occur with pumps of these types on account of the closing volume of the valves or valve leaks.

✎ Note:
Before carrying out the Quick Setup “Pulsating Flow” the Quick Setup “Commissioning” (see Page 60) has to be executed.

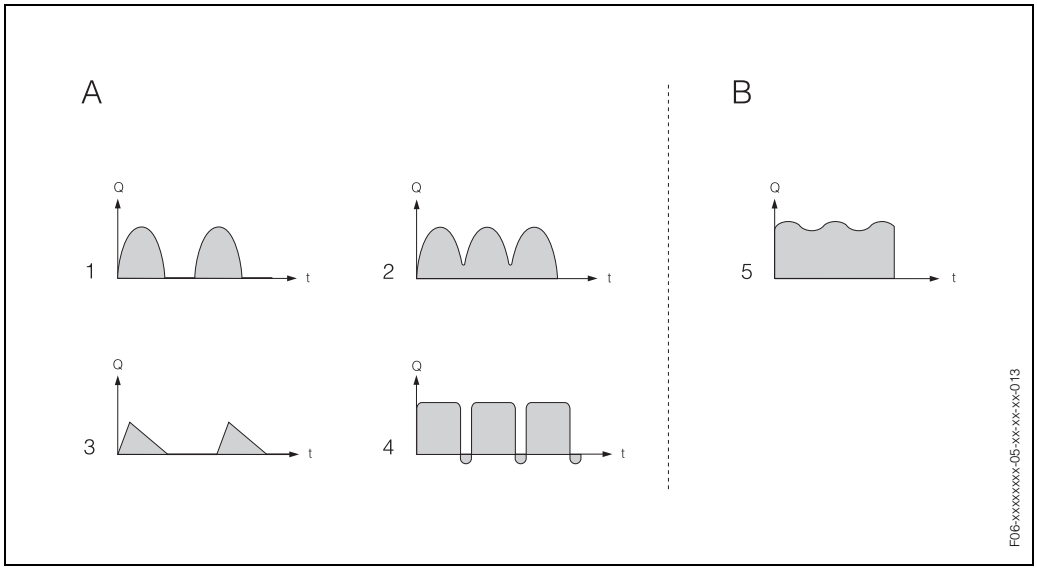


Fig. 29: Flow characteristics of various types of pump

A = With severely pulsating flow
B = With slightly pulsating flow

1 1-cylinder cam pump
2 2-cylinder cam pump
3 Magnetic pump
4 Peristaltic pump, flexible connecting hose
5 Multi-cylinder reciprocating pump

Severely pulsating flow
Once several device functions have been configured in the “Pulsating flow” Quick Setup menu, flow fluctuations of this nature can be compensated over the entire flow range and pulsating fluid flows measured correctly. You will find detailed instructions on how to use this Quick Setup menu on Page 63.

✎ Note:
It is always advisable to work through the “Pulsating flow” Quick Setup menu if there is any uncertainty about the exact flow characteristic.

Slightly pulsating flow
If flow fluctuations are no more than minor, as is the case, for example with gear-type, three-cylinder or multi-cylinder pumps, it is **not** absolutely necessary to work through the Quick Setup menu.
In cases of this nature, however, it is advisable to adapt the functions listed below in the function matrix (see the “Description of Device Functions” manual) to suit local process conditions in order to ensure a stable, unvarying output signal:

- Measuring system damping: FLOW DAMPING function → increase the value
- Current output damping: TIME CONSTANT function → increase the value

Performing the "Pulsating flow" Quick Setup

This Quick Setup menu guides you systematically through the setup procedure for all the device functions that have to be parameterised and configured for measuring pulsating flows. Note that this has no effect on values configured beforehand, such as measuring range, current range or full scale value.

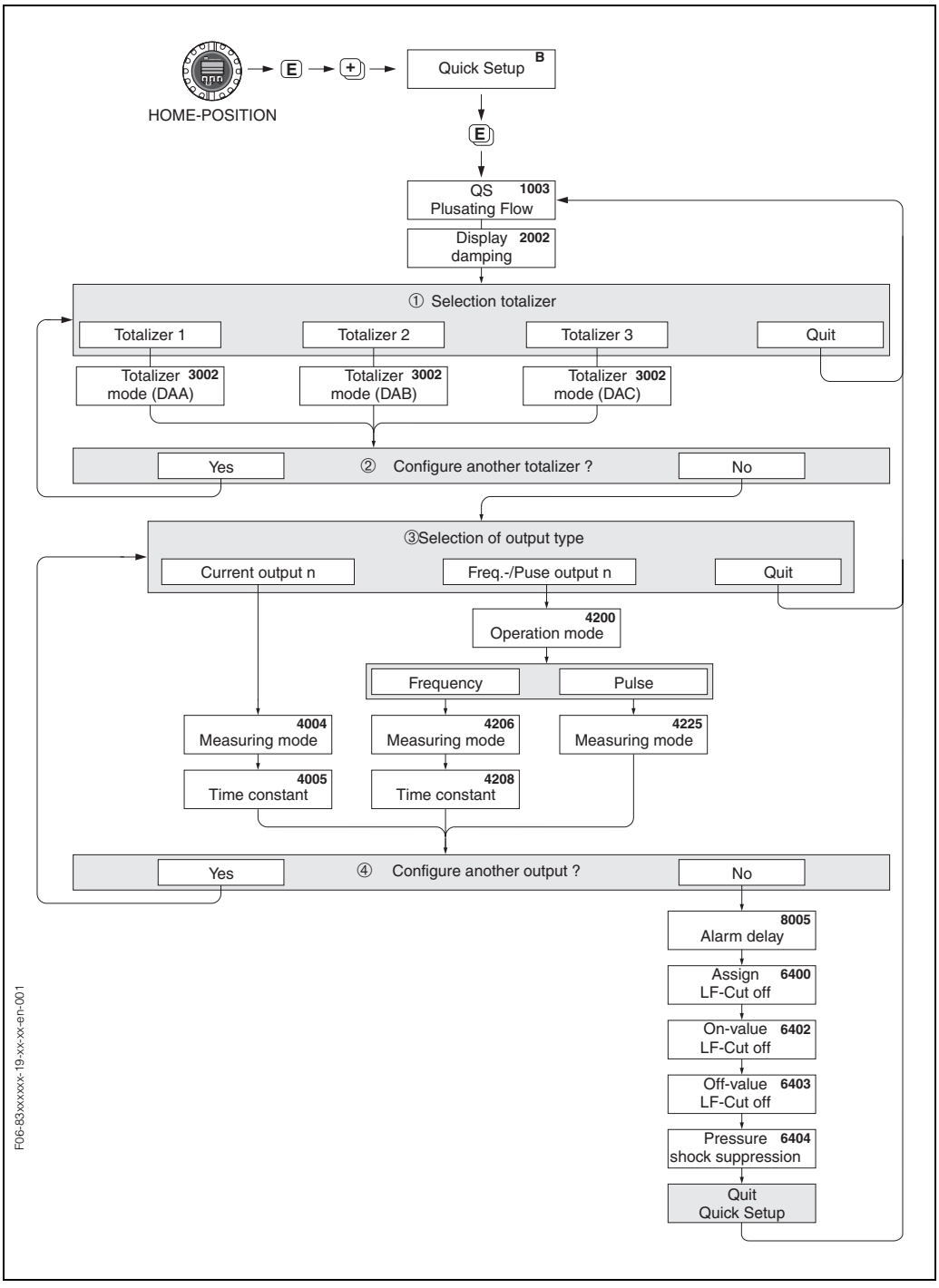


Fig. 30: Quick Setup for measuring severely pulsating flows
Recommended settings → see next page

“Pulsating flow” Quick Setup menu		
HOME position → E → MEASURED VARIABLE MEASURED VARIABLE → + → QUICK SETUP QUICK SETUP → E → QS PULSATING FLOW		
Function No.	Function name	Setting to select (+/-)
1003	QS PULSATING FLOW	YES After E is pressed by way of confirmation, the Quick Setup menu calls up all the subsequent functions in succession.
▼		
Basic configuration		
2002	DISPLAY DAMPING	1 s
3002	TOTALIZER MODE (DAA)	BALANCE (Totalizer 1)
3002	TOTALIZER MODE (DAB)	BALANCE (Totalizer 2)
3002	TOTALIZER MODE (DAC)	BALANCE (Totalizer 3)
Signal type for “CURRENT OUTPUT 1...n”		
4004	MEASURING MODE	PULSATING FLOW
4005	TIME CONSTANT	1 s
Signal type for “PULSE/FREQ. OUTPUT 1...n” (for FREQUENCY operating mode)		
4206	MEASURING MODE	PULSATING FLOW
4208	TIME CONSTANT	0 s
Signal type for “PULSE/FREQ. OUTPUT 1...n” (for PULSE operating mode)		
4225	MEASURING MODE	PULSATING FLOW
Other settings		
8005	ALARM DELAY	0 s
6400	ASSIGN LOW FLOW CUTOFF	MASS FLOW
6402	ON-VALUE LOW FLOW CUT OFF	Setting depends on diameter: DN 1 = 0.02 [kg/h] resp. [l/h] DN 2 = 0.10 [kg/h] resp. [l/h] DN 4 = 0.45 [kg/h] resp. [l/h] DN 8 = 2.0 [kg/h] resp. [l/h] DN 15 = 6.5 [kg/h] resp. [l/h] DN 15* = 18 [kg/h] resp. [l/h] DN 25 = 18 [kg/h] resp. [l/h] DN 25* = 45 [kg/h] resp. [l/h] DN 40 = 45 [kg/h] resp. [l/h] DN 40* = 70 [kg/h] resp. [l/h] DN 50 = 70 [kg/h] resp. [l/h] DN 80 = 180 [kg/h] resp. [l/h] DN 100 = 350 [kg/h] resp. [l/h] DN 150 = 650 [kg/h] resp. [l/h] * DN 15, 25, 40 “FB” = Full bore versions of Promass I
▼		
6403	OFF-VALUE LOW FLOW CUTOFF	50%
6404	PRESSURE SHOCK SUPPRESSION	0 s
▼		
Back to the HOME position → Press and hold down Esc key (-/+) for longer than three seconds. → Repeatedly press and release Esc key (-/+) → exit the function matrix step by step		

6.2.4 Quick Setup "Batching"

This Quick Setup menu guides you systematically through the setup procedure for all the device functions that have to be parameterised and configured for batching operation. These basic settings allow simple (one step) batching processes.
Additional settings, e.g. for the calculation of after runs or for multi-stage batching procedures, must be made via the function matrix itself (see the "Description of Device Functions" manual).

Note!
- Before carrying out the Quick Setup "Batching" the Quick Setup "Commissioning" (see Page 60) has to be executed.
- This function is only available when the additional "batching" software is installed in the measuring device (order option). You can order this software from E+H as an accessory at a later date (see Page 87).
- You can find detailed information on the batching functions in the separate "Description of Device Functions" manual.
- You can also directly control filling process using the local display. During Quick Setup, an appropriate dialogue appears concerning the automatic display configuration. Exit this by clicking "YES".
  This assigns special batching functions (START, PRESET, MATRIX) to the bottom line of the display. These can be directly executed on-site using the three operating keys (–/+/E). Therefore, Promass 83 can be fully deployed in the field as a "batch controller" → Page 39.

Caution!
The "Batching" Quick Setup sets certain device parameters for discontinuous measurement operation. If the measuring instrument is used for continuous flow measurement at a later time, we recommend at you rerun the "Commissioning" and/or "Pulsating Flow" Quick Setup.

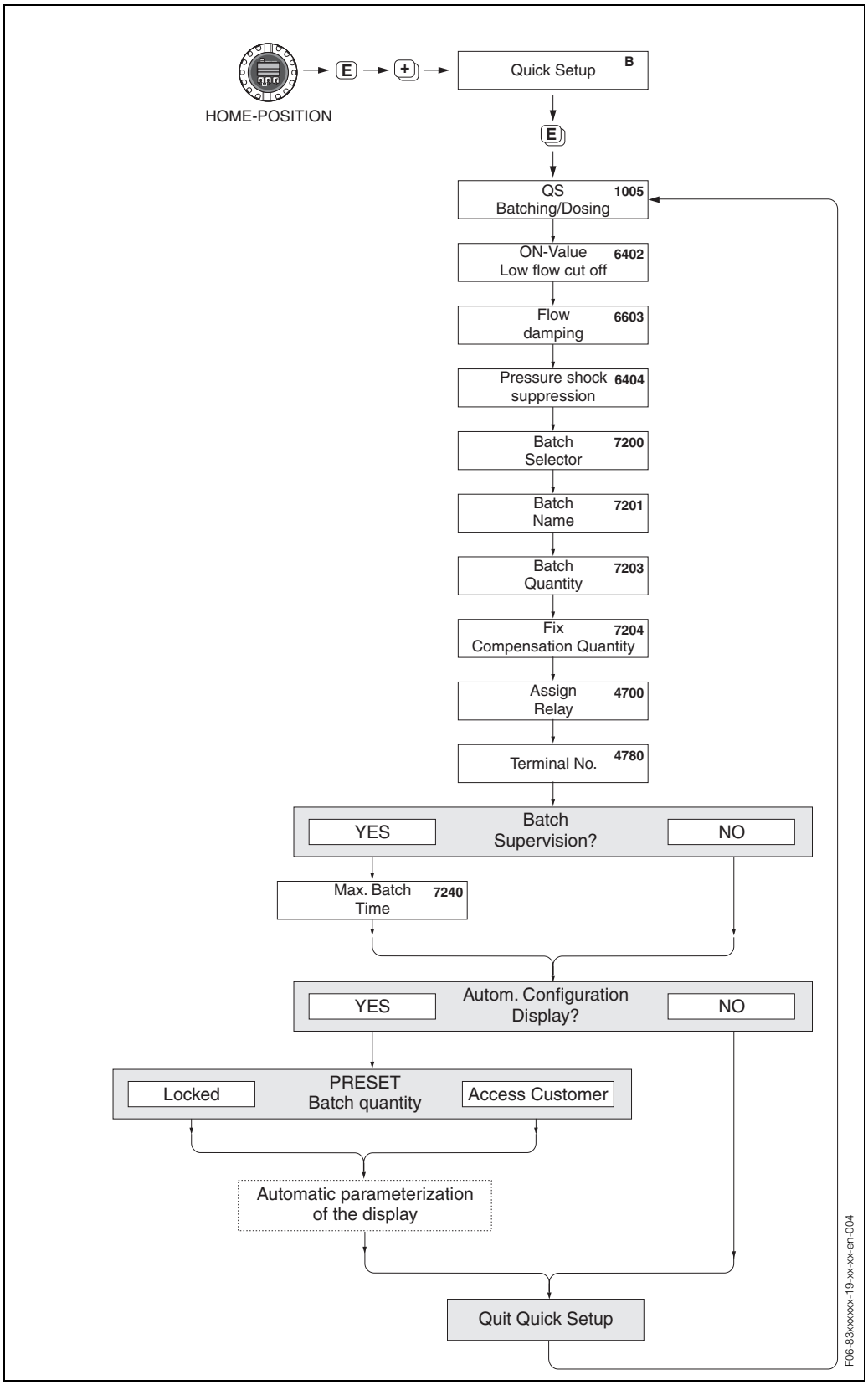


Fig. 31: "Batching" Quick Setup for configuration of batching functions
Recommended settings → see next page

"Batching" Quick Setup menu

HOME position → E → MEASURED VARIABLE (A)
MEASURED VARIABLE → + → QUICK SETUP (B)
QUICK SETUP → 🖐 → QUICK SETUP BATCHING / DOSING (1005)

Function No.	Function name	Setting to select (+ -) (Go to next function: press E)
1005	QUICK SETUP BATCHING / DOSING	YES After E is pressed by way of confirma-tion, the Quick Setup menu calls up all the sub-sequent functions in succession.

▼

✎ Warning:
Some of the functions listed below (with a grey background) are configured automatically, i.e. by the measuring system.

6400	ASSIGN LOW FLOW CUTOFF	MASS FLOW
6402	ON-VALUE LOW FLOW CUTOFF	see Table on Page 68
6403	OFF-VALUE LOW FLOW CUTOFF	50%
6603	FLOW DAMPING	0 seconds
6404	PRESSURE SHOCK SUPPRESSION	0 seconds
7200	BATCH SELECTOR	BATCH #1
7201	BATCH NAME	BATCH #1
7202	ASSIGN BATCH VARIABLE	MASS
7203	BATCH QUANTITY	0 [unit]
7204	FIX COMPENSATION QUANTITY	0 [unit]
7205	COMPENSATION MODE	OFF
7208	BATCH STAGES	1
7209	INPUT FORMAT	Value input
4700	ASSIGN RELAY	BATCH VALVE 1
4780	TERMINAL NUMBER	Output (display only)
7220	OPEN VALVE 1	0% or 0 [unit]
7240	MAXIMUM BATCH TIME	0 seconds (= switched off)
7241	MINIMUM BATCH QUANTITY	0
7242	MAXIMUM BATCH QUANTITY	0
2200	ASSIGN (main line)	BATCH NAME
2220	ASSIGN (multiplex main line)	OFF
2400	ASSIGN (addition line)	BATCH DOWNWARDS
2420	ASSIGN (multiplex addition line)	OFF
2600	ASSIGN (information line)	BATCHING KEYS
2620	ASSIGN (multiplex information line)	OFF

▼

Back to the HOME position
→ Press and hold down Esc key (- + E) for longer than three seconds.
→ Repeatedly press and release Esc key (- + E) → exit the function matrix step by step

Nominal diameter	Low flow cutoff / factory settings (v ~ 0.04 m/s)	
[mm]	SI units [kg/h]	US units [lb/min]
1	0.08	0.003
2	0.40	0.015
4	1.80	0.066
8	8.00	0.300
15	26.00	1.000
15 FB *	72.00	2.600
25	72.00	2.600
25 FB *	180.00	6.600
40	180.00	6.600
40 FB *	300.00	11.000
50	300.00	11.000
80	720.00	26.000
100	1200.00	44.000
150	2600.00	95.000
* DN 15, 25, 40 “FB” = Full bore version of Promass I		

6.2.5 Quick Setup "Gas Measurement"

Promass 83 is not only suitable for measuring liquid flow. Direct mass measurement based on the Coriolis principle is also possible for measuring the flow rate of gases.

Note:
- Before carrying out the Quick Setup "Gas Measurement" the Quick Setup "Commissioning" (see Page 60) has to be executed.
- Only mass and Corrected volume flow can be measured and output with the gas measurement mode. Note that direct density and/or volume measurement is not possible!
- The flow ranges and measuring accuracy that apply to gas measurement are not the same as those for liquids.
- If Corrected volume flow (e.g. in Nm^3/h) is to be measured and output instead of the mass flow (e.g. in kg/h), change the setting for the CORRECTED VOLUME CALCULATION function to "FIXED REFERENCE DENSITY" in the "Commissioning" Quick Setup menu. Corrected volume flow can be assigned as follows:
  – to a display line
  – to the current output
  – to the pulse/frequency output

Performing the "Gas Measurement" Quick Setup
This Quick Setup menu guides you systematically through the setup procedure for all the device functions that have to be parameterised and configured for gas measurement.

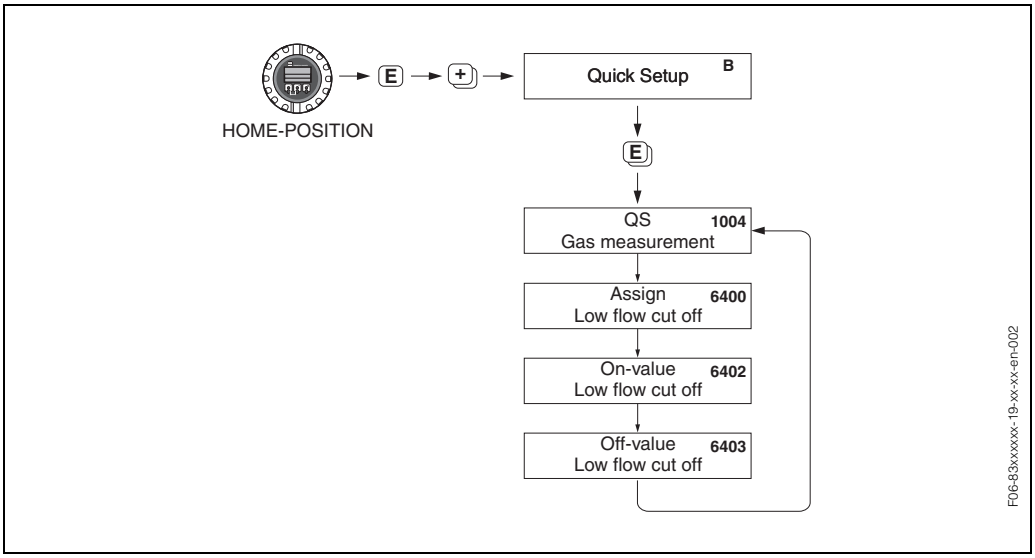


Fig. 32: Quick Setup for measuring gases. Recommended settings → see next page

.

“Gas Measurement” Quick Setup menu		
HOME position → E → MEASURED VARIABLE (A) MEASURED VARIABLE → + → QUICK SETUP (B) QUICK SETUP → E → QS GAS MEASUREMENT (1004)		
Function No.	Function name	Setting to select (+ –) (Go to next function: press E)
1004	QS GAS MEASUREMENT	YES After E is pressed by way of confirmation, the Quick Setup menu calls up all the subsequent functions in succession.
▼		
6400	ASSIGNMENT LOW FLOW CUTOFF	On account of the low mass flow involved when gas flows are measured, it is advisable not use a low flow cutoff. Setting: OFF
6402	ON-VALUE LOW FLOW CUTOFF	If the ASSIGNMENT LOW FLOW CUTOFF function was not set to “OFF”, the following applies: Setting: 0.0000 [unit] User input: Flow rates for gas measurements are low, so the value for the switch-on point (= low flow cutoff) must be correspondingly low.
6403	OFF-VALUE LOW FLOW CUTOFF	If the ASSIGNMENT LOW FLOW CUTOFF function was not set to “OFF”, the following applies: Setting: 50% User input: Enter the switch-off point as a positive hysteresis in %, referenced to the switch-on point.
▼		
Back to the HOME position: → Press and hold down Esc key (– +) for longer than three seconds. → Repeatedly press and release Esc key (– +) → exit the function matrix step by step		

✎ Note:
Quick Setup automatically deactivates the function EMPTY PIPE DETECTION (6420) so that the instrument can measure flow at low gas pressures.

6.2.6 Zero point adjustment

All Promass measuring devices are calibrated with state-of-the-art technology. The zero point obtained in this way is printed on the nameplate. Calibration takes place under reference operating conditions (see Page 115). Consequently, the zero point adjustment is generally **not** necessary for Promass.

Experience shows that the zero point adjustment is advisable only in special cases:
- To achieve highest measuring accuracy also with very small flow rates.
- Under extreme process or operating conditions (e.g. very high process temperatures or very high viscosity fluids).

Preconditions for a zero point adjustment
Note the following before you perform a zero point adjustment:
- A zero point adjustment can be performed only with fluids that contain no gas or solid contents.
- Zero point adjustment is performed with the measuring tubes completely filled and at zero flow (v = 0 m/s). This can be achieved, for example, with shut-off valves upstream and/or downstream of the sensor or by using existing valves and gates (Fig. 33):
  – Normal operation → valves 1 and 2 open
  – Zero point adjustment *with* pump pressure → valve 1 open / valve 2 closed
  – Zero point adjustment *without* pump pressure → valve 1 closed / valve 2 open

Caution:
- If the fluid is very difficult to measure (e.g. containing entrained solids or gas) it may prove impossible to obtain a stable zero point despite repeated zero point adjustments. In instances of this nature, please contact your E+H service center.
- You can view the currently valid zero point value using the “ZERO POINT” function (see the “Description of Device Functions” manual).

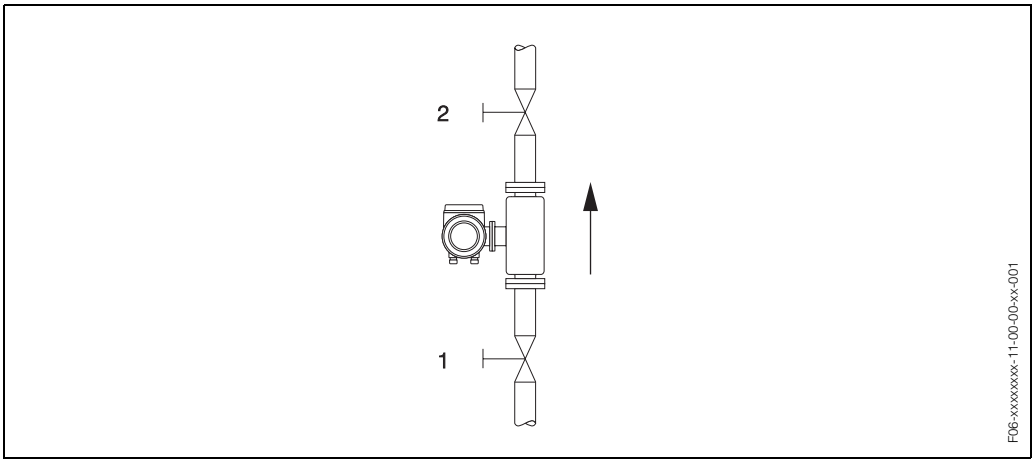


Fig. 33: Zero point adjustment and shut-off valves

Performing a zero point adjustment

1. Operate the system until operating conditions have settled.
2. Stop the flow (v = 0 m/s).
3. Check the shut-off valves for leaks.
4. Check that operating pressure is correct.
5. Using the local display, select the “ZEROPOINT ADJUSTMENT” function in the function matrix:

   HOME → E → ⊞ → BASIC FUNCTIONS
   BASIC FUNCTIONS → E → ⊞ → PROCESSPARAMETER
   PROCESSPARAMETER → E → ⊞ → ADJUSTMENT
   ADJUSTMENT → E → ZEROPOINT ADJUSTMENT

6. When you press ± you are automatically prompted to enter the access code if the function matrix is still disabled. Enter the code.
7. Use ± to select START and press E to confirm.
   Select YES at the prompt and press E again to confirm.
   Zero point adjustment now starts.
   – The message “ZEROPOINT ADJUST RUNNING” appears on the display for 30...60 seconds while adjustment is in progress.
   – If the flow in the pipe exceeds 0.1 m/s, the following error message appears on the display: ZERO ADJUST NOT POSSIBLE.
   – When the zero point adjustment completes, the “ZERO ADJUST.” function reappears on the display.
8. Back to the HOME position:
   – Press and hold down the Esc key (− +) for longer than three seconds.
   – Repeatedly press and release the Esc key (− +).

6.2.7 Density adjustment

It is advisable to perform a density adjustment when optimum measuring accuracy is required for calculating density dependent values. The application may require a 1-point or 2-point density adjustment.

1-point density adjustment (with one fluid):
This type of density adjustment is necessary under the following circumstances:
- The sensor does not measure exactly the density value that the user expects on the basis of laboratory analyses.
- The fluid properties are outside the measuring points set at the factory, or the reference operating conditions used to calibrate the measuring device.
- The system is used exclusively to measure a fluid’s density which must be registered to a high degree of accuracy under constant conditions.
  Example: Brix density measurement for apple juice.

2-point density adjustment (with two fluids):
This type of adjustment is always to be carried out if the measuring tubes have been mechanically altered by, e.g. material build-up, abrasion or corrosion. In such cases, the resonant frequency of the measuring tubes has been affected by these factors and is no longer compatible with the calibration data set at the factory.
The 2-point density adjustment allows for these mechanical changes and recalculates new revised data.

Performing a 1-point or 2-point density adjustment

Caution:
- On-site density adjustment can be performed only if the user has detailed knowledge of the fluid density, obtained for example from detailed laboratory analyses.
- The target density value specified in this way must not deviate from the measured fluid density by more than ±10%.
- An error in defining the target density affects all calculated density and volume functions.
- The 2-point density adjustment is only possible if both target density values are different from each other by at least 0.2 kg/l.
- Density adjustment changes the factory density calibration values or the calibration values set by the service technician.

1. Fill the sensor with fluid. Make sure that the measuring tubes are completely filled and that liquids are free of gas bubbles.
2. Wait until the temperature difference between fluid and measuring tube has equalised. The time you have to wait for equalisation depends on the fluid and the temperature level.
3. Using the local display, select the “SETPOINT DENSITY” function in the function matrix and perform density adjustment as follows:

HOME → E → ⊞ → BASIC FUNCTIONS
BASIC FUNCTIONS → E → ⊞ → PROCESSPARAMETER
PROCESSPARAMETER → E → ⊞ → ADJUSTMENT
ADJUSTMENT → E → DENSITY SET VALUE

▼

Function No.	Function name	Setting to select (⊞) (Go to next function: press E)
6480	DENSITY SET VALUE	Use ⊞ to select a 1- or 2-point adjustment. ✎ Note: If the function matrix is still locked, then you are automatically prompted to enter the access code when pressing the ⊞ keys. Enter the code.
6483	DENSITY SET VALUE 1	Use ⊞ to enter the target density of the first fluid and press E to save this value (input range = actual density value ±10%).
6484	MEASURE FLUID 1	Use ⊞ to select START and press E. The message “DENSITY MEASUREMENT RUNNING” appears on the display for approximately 10 seconds. During this time Promass measures the current density of the first fluid (measured density value).

▼

For 2-point density adjustment only:

6485	DENSITY SET VALUE 2	Use ⊞ to enter the target density of the second fluid and press E to save this value (input range = actual density value ±10%).
6486	MEASURE FLUID 2	Use ⊞ to select START and press E. The message “DENSITY MEASUREMENT RUNNING” appears on the display for approximately 10 seconds. During this time Promass measures the current density of the second fluid (measured density value).

▼

6487	DENSITY ADJUSTMENT	Use ⊞ to select DENSITY ADJUSTMENT and press ⊞. Promass compares the measured density value and the target density value and calculates the new density coefficient.
6488	RESTORE ORIGINAL	If the density adjustment does not complete correctly, you can select the RESTORE ORIGINAL function to reactivate the default density coefficient.

▼

Back to the HOME position:
→ Press and hold down Esc key (⊞ ⊞) for longer than three seconds.
→ Repeatedly press and release Esc key (⊞ ⊞) → exit the function matrix step by step

6.2.8 Concentration measurement

The Promass 83 determines three primary variables simultaneously:
- Mass flow
- Fluid density
- Fluid temperature

As standard, these measured variables allow other process variables to be calculated, such as volume flow, reference density (density at reference temperature) and corrected volume flow.

The optional software package "Concentration measurement" (F-Chip, accessories → Page 87) offers a multitude of additional density functions. Additional evaluation methods are available in this way, especially for special density calculations in all types of applications:
- calculating percentage contents, mass and volume flow in two-phase media (carrier fluid and target fluid)
- converting density of the fluid into special density units, e.g. °Brix, °Baumé, °API, etc.

Concentration measurement with fixed calculation function
By means of the "DENSITY FUNCTION (7000)" function, you can select various density functions (Fig. 34) which use a fixed specified calculation mode for calculating concentration:

Density function	Remarks
% MASS % VOLUME	By using the functions for two-phase-media, it is possible to calculate the percentage mass or volume contents of the carrier fluid or the target fluid. The basic equations (without temperature compensation) are: $\text{Mass [\%]} = \frac{D2 \cdot (\rho - D1)}{\rho \cdot (D2 - D1)} \cdot 100\%$ $\quad$ $\text{Volume [\%]} = \frac{(\rho - D1)}{(D2 - D1)} \cdot 100\%$ D1 = density of carrier fluid (transporting liquid, e.g. water) D2 = density of target fluid (material transported, e.g. lime powder or a second liquefied material to be measured) ρ = measured overall density
°BRIX	Density unit used for the Food & Beverage industry which deals with the saccharose content of aqueous solutions, e.g. for measuring solutions containing sugar such as fruit juice, etc. The ICUMSA table for Brix units given on Page 76 is the basis for calculations within Promass 83.
°BAUME	This density unit or scale is mainly used for acidic solutions, e.g. ferric chloride solutions. Two Baumé scales are used in practice: • BAUME > 1 kg/l: for solutions heavier than water • BAUME < 1 kg/l: for solutions lighter than water
°BALLING °PLATO	A commonly used basis for calculating the fluid density in the brewery industry. A fluid with a value of 1° BALLING (Plato) has the same density as a water/cane sugar solution consisting of 1 kg cane sugar dissolved in 99 kg of water. 1° Balling (Plato) is thus 1% of the liquid weight.
%-BLACK LIQUOR	The units of concentration used in the paper industry for black liquor in % by mass. The formula used for the calculation is the same as for %-MASS.
°API	°API (= American Petroleum Institute) Density units specifically used in North America for liquefied oil products.

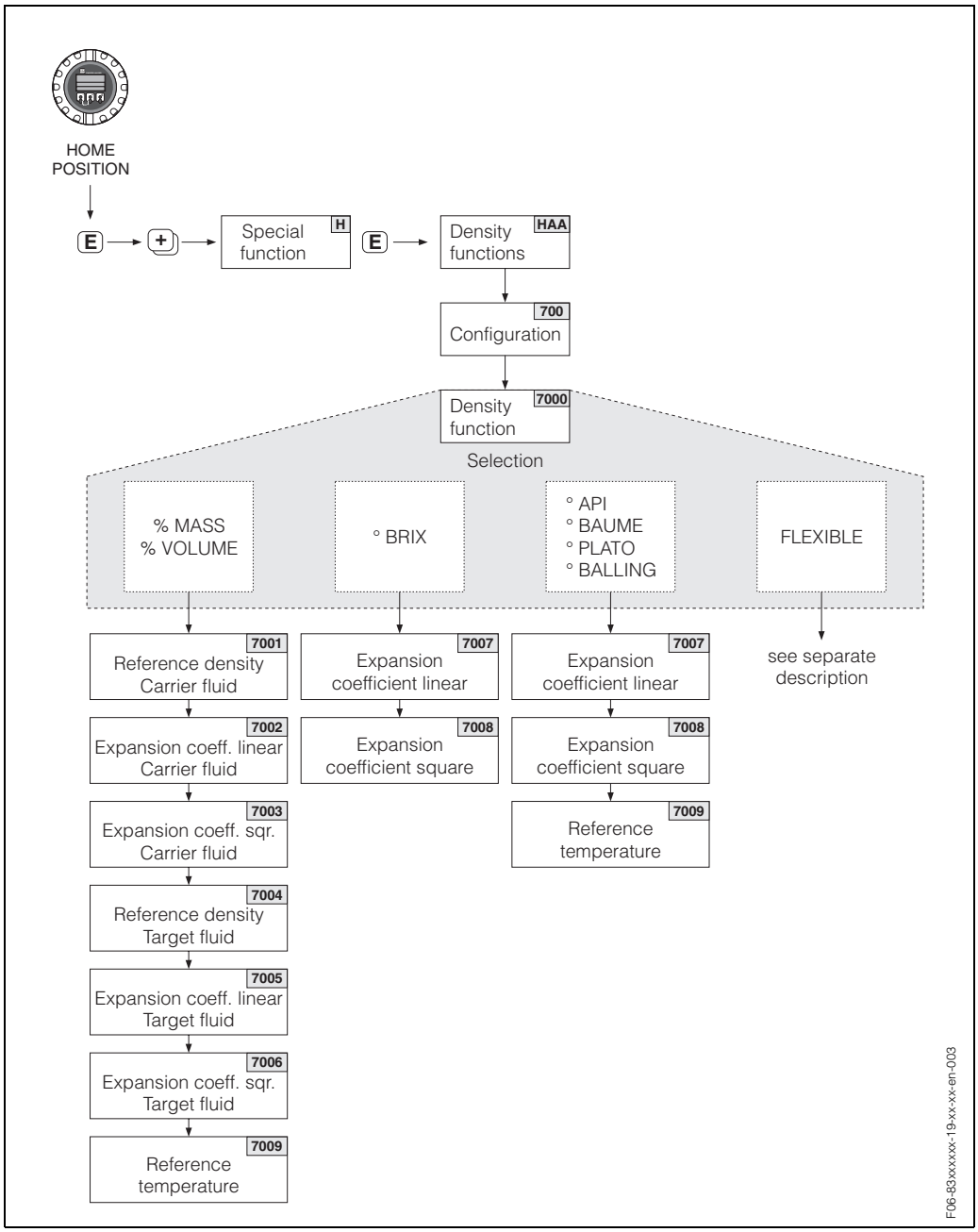


Fig. 34: Selecting and configuring different density functions in the function matrix

Brixgrade (density of hydrous saccharose solution in kg/m³)								
°Brix	**10°C**	**20°C**	**30°C**	**40°C**	**50°C**	**60°C**	**70°C**	**80°C**
0	999.70	998.20	995.64	992.21	988.03	983.19	977.76	971.78
5	1019.56	1017.79	1015.03	1011.44	1007.14	1002.20	996.70	989.65
10	1040.15	1038.10	1035.13	1031.38	1026.96	1021.93	1016.34	1010.23
15	1061.48	1059.15	1055.97	1052.08	1047.51	1042.39	1036.72	1030.55
20	1083.58	1080.97	1077.58	1073.50	1068.83	1063.60	1057.85	1051.63
25	1106.47	1103.59	1099.98	1095.74	1090.94	1085.61	1079.78	1073.50
30	1130.19	1127.03	1123.20	1118.80	1113.86	1108.44	1102.54	1096.21
35	1154.76	1151.33	1147.58	1142.71	1137.65	1132.13	1126.16	1119.79

Brixgrade (density of hydrous saccharose solution in kg/m³)								
°Brix	**10°C**	**20°C**	**30°C**	**40°C**	**50°C**	**60°C**	**70°C**	**80°C**
40	1180.22	1176.51	1172.25	1167.52	1162.33	1156.71	1150.68	1144.27
45	1206.58	1202.61	1198.15	1193.25	1187.94	1182.23	1176.14	1169.70
50	1233.87	1229.64	1224.98	1219.93	1214.50	1208.70	1202.56	1196.11
55	1262.11	1257.64	1252.79	1247.59	1242.05	1236.18	1229.98	1223.53
60	1291.31	1286.61	1281.59	1276.25	1270.61	1264.67	1258.45	1251.88
65	1321.46	1316.56	1311.38	1305.93	1300.21	1294.21	1287.96	1281.52
70	1352.55	1347.49	1342.18	1336.63	1330.84	1324.80	1318.55	1312.13
75	1384.58	1379.38	1373.88	1368.36	1362.52	1356.46	1350.21	1343.83
80	1417.50	1412.20	1406.70	1401.10	1395.20	1389.20	1383.00	1376.60
85	1451.30	1445.90	1440.80	1434.80	1429.00	1422.90	1416.80	1410.50

Source: A. & L. Emmerich, Technical University of Brunswick; officially recommended by ICUMSA, 20th session 1990

Concentration measurement with flexible calculation function
Under certain application conditions, it may not be possible to use density functions with a fixed calculation function (% mass, °Brix, etc).
However, user-specific or application-specific concentration calculations can be used with the "FLEXIBLE" setting in the function "DENSITY FUNCTION (7000)".

The following types of calculation can be selected in function "MODE (7021)":
- % MASS 3D
- % VOLUME 3D
- % MASS 2D
- % VOLUME 2D
- OTHER 3D
- OTHER 2D

Calculation type "% MASS 3D" or "% VOLUME 3D"
For this type of calculation, the relationship between the three variables – concentration, density and temperature must be known (3-dimensional), e.g. by a table. In this way, the concentration can be calculated from the measured density and temperature values by means of the following formula (the coefficients A0, A1, etc. have to be determined by the user):

$$C = A0 + A1 \cdot \rho + A2 \cdot \rho^2 + A3 \cdot \rho^3 + A4 \cdot \rho^4 + B1 \cdot T + B2 \cdot T^2 + B3 \cdot T^3$$

C = Concentration
ρ = currently measured density
A0 = value from function COEFFICIENT A0 (7032)
A1 = value from function COEFFICIENT A1 (7033)
A2 = value from function COEFFICIENT A2 (7034)
A3 = value from function COEFFICIENT A3 (7035)
A4 = value from function COEFFICIENT A4 (7036)
B1 = value from function COEFFICIENT B1 (7037)
B2 = value from function COEFFICIENT B2 (7038)
B3 = value from function COEFFICIENT B3 (7039)
T = currently measured temperature in °C

Example:
The following is a concentration table from a reference source.

Temperature / Density	10°C	15°C	20°C	25°C	30°C
825 kg/m³	93.6%	92.5%	91.2%	90.0%	88.7%
840 kg/m³	89.3%	88.0%	86.6%	85.2%	83.8%
855 kg/m³	84.4%	83.0%	81.5%	80.0%	78.5%
870 kg/m³	79.1%	77.6%	76.1%	74.5%	72.9%
885 kg/m³	73.4%	71.8%	70.2%	68.6%	66.9%
900 kg/m³	67.3%	65.7%	64.0%	62.3%	60.5%
915 kg/m³	60.8%	59.1%	57.3%	55.5%	53.7%

Note:
The coefficients for the Promass 83 concentration algorithm should be determined with the density in units of kg/liter, temperature in °C and concentration in decimal form (0.50, not 50%). B1, B2 and B3 need to be entered into the matrix positions 7037, 7038 and 7039 in scientific notation as $10^{-3,}$ 10^{-6} and 10^{-9} respectively.

Assume:
Density (ρ): 870 kg/m³ → 0.870 kg/l
Temperature (T): 20°C

Coefficients determined for table above:
A0 = -2.6057
A1 = 11.642
A2 = -8.8571
A3 = 0
A4 = 0
B1 = $-2.7747 \cdot 10^{-3}$
B2 = $-7.3469 \cdot 10^{-6}$
B3 = 0

Calculation:

$$C = A0 + A1 \cdot \rho + A2 \cdot \rho^2 + A3 \cdot \rho^3 + A4 \cdot \rho^4 + B1 \cdot T + B2 \cdot T^2 + B3 \cdot T^3$$
$$= -2.6057 + 11.642 \cdot 0.870 + (-8.8571) \cdot 0.870^2 + 0 \cdot 0.870^3 + 0 \cdot 0.870^4 + (-2.7747) \cdot 10^{-3} \cdot 20 + (-7.3469) \cdot 10^{-6} \cdot 20^2 + 0 \cdot 20^3$$
$$= 0.7604$$
$$= \mathbf{76.04\%}$$

Calculation type "% MASS 2D" or "% VOLUME 2D"
For this type of calculation, the relationship between the two variables concentration and reference density must be known (2-dimensional), e.g. by a table. In this way, the concentration can be calculated from the measured reference density by means of the following formula (the coefficients A0, A1, etc. have to be determined either by the user or by the FieldTool program):

$$C = A0 + A1 \cdot \rho_{ref} + A2 \cdot \rho_{ref}^2 + A3 \cdot \rho_{ref}^3 + A4 \cdot \rho_{ref}^4$$

C = Concentration
ρ_{ref} = currently measured reference density
A0 = value from function COEFFICIENT A0 (7032)
A1 = value from function COEFFICIENT A1 (7033)
A2 = value from function COEFFICIENT A2 (7034)
A3 = value from function COEFFICIENT A3 (7035)
A4 = value from function COEFFICIENT A4 (7036)

Note!
Promass determines the reference density by means of the density and temperature currently measured. To do so, both the reference temperature (function REFERENCE TEMPERATURE) and the expansion coefficients (function EXPANSION COEFF. .....) must be entered in the measuring system.
The parameters important for measuring the reference density can also be configured directly via the "Commissioning" Quick Setup menu.

Calculation type "OTHER 3D" or "OTHER 2D"
With this option, users can enter a free selectable designation for their specific concentration unit or target parameters (see function TEXT ARBITRARY CONCENTRATION (0606)).

6.2.9 Advanced diagnostic functions

Changes to the measuring system, e.g. coating build-up or corrosion and abrasion on the measuring tubes can be detected at an early stage by means of the optional software package “Advanced Diagnostics” (F-Chip, accessories → Page 87). Normally, these influences reduce the measuring accuracy of the system or may lead to serious system errors.
By means of the diagnostic functions it is now possible to record various process and device parameters during operation, e.g. mass flow, density/reference density, temperature values, measuring tube damping etc.
By analysing the trend of these measured values, deviations of the measuring system from a “reference status” can be detected in good time and corrective measures can be taken.

Reference values as the basis for trend analysis
Reference values of the parameters in question must always be recorded for trend analysis. These reference values are determined under reproducible, constant conditions. Such reference values are initially recorded during calibration at the factory and saved in the measuring device.
Reference data can also be ascertained under customer-specific process conditions, e.g. during commissioning or at certain process stages (cleaning cycles, etc.).
Reference values are recorded and saved in the measuring system always by means of the device function → REFERENCE CONDITION USER (7401).

Caution!
It is not possible to analyse the trend of process/device parameters without reference values! Reference values can only be determined under constant, non-changing process conditions.

Methods of ascertaining data
Process and device parameters can be recorded in two different ways which you can define in the function → ACQUISITION MODE (7410):
- “PERIODICAL” option: Measuring device acquires data periodically. Enter the desired time interval by means of the function “ACQUISITION PERIODE (7411)”.
- “SINGLE SHOT” option: The user himself acquires the data manually at different, free selectable periods.

Ensure that the process conditions always correspond to the reference status when data is being recorded. It is only in this way that deviations from the reference status can be clearly determined.

Note!
The last ten entries are retained in chronological order in the measuring system.
The “history” of such values can be called up via various functions:

Diagnosis parameters	Data saved (per parameter)
Mass flow Density Reference density Temperature Meas. tube damping Sensor symmetry	• Reference value → “REFERENCE VALUE” function • Lowest measured value → “MINIMUM VALUE” function • Highest measured value → “MAXIMUM VALUE” function • List of the last ten measured values → “HISTORY 1” function • Deviation measured/reference value → “ACTUAL DEVIATION” function
✎ Note: More detailed information can be found in the “Description of Device Functions” Manual.	

Triggering warning messages
If required, a limit value can be assigned to all the process/device parameters relevant to the diagnostic functions. A warning message is triggered if this limit value is exceeded → function "WARNING MODE (7403)".
The limit value is entered into the measuring system as an absolute (+/–) or relative deviation from the reference value → function "WARNING LEVEL (74...)".
Deviations arising and recorded by the measuring system can also be output via the current or relay outputs.

Data interpretation
The way the data recorded by the measuring system is interpreted depends largely on the application in question. This means that users must have a very good knowledge of their specific process conditions and the related deviation tolerances in the process, which have to be determined by the users themselves in each individual case.
For example, when using the limit function it is especially important to know the minimum and maximum deviation tolerances allowed. Otherwise there is the danger that a warning message is triggered inadvertently during "normal" process fluctuations.

There can be various reasons for deviating from the reference status. The following table provides examples and pointers for each of the six diagnosis parameters recorded:

Diagnosis parameters	Possible reasons for deviation
Mass flow	A deviation from the reference status indicates possible zero point shift.
Density	A deviation from the reference status can be caused by a change in the measuring tube resonance frequency, e.g. from deposits in the measuring tube, corrosion or abrasion.
Reference density	The reference density values can be interpreted in the same way as the density values. If the fluid temperature cannot be kept completely constant, you can analyse the reference density (= density at a constant temperature, e.g. at 20 °C) instead of the density. Ensure that the parameters required for calculating the reference density have been correctly configured (functions REFERENCE TEMPERATURE and EXPANSION COEFF.).
Temperature	Use this diagnosis parameter to check the functionality of the PT 100 temperature sensor.
Measuring tube damping	A deviation from the reference status can be caused by a change in measuring tube damping, e.g. from mechanical changes (coating build-up, corrosion, abrasion).
Sensor symmetry	Use this diagnosis parameter to determine whether the sensor signals are symmetrical.

6.2.10 Current output: active/passive

The current outputs are configured as “active” or “passive” by means of various jumpers on the I/O board or the current submodule.

Warning:
Risk of electric shock. Exposed components carry dangerous voltages. Make sure that the power supply is switched off before you remove the cover of the electronics compartment.

1. Switch off power supply.
2. Remove the I/O board → Page 104, 106
3. Set the jumpers in accordance with Fig. 35.

   Caution:
   – Risk of destroying the measuring device. Set the jumpers exactly as shown in Fig. 35. Incorrectly set jumpers can cause overcurrents that would destroy either the measuring device or external devices connected to it.
   – Note that the position of the current submodule on the I/O board can vary, depending on the version ordered, and that the terminal assignment in the connection compartment of the transmitter varies accordingly → Page 29.
4. Installation of the I/O board is the reverse of the removal procedure.

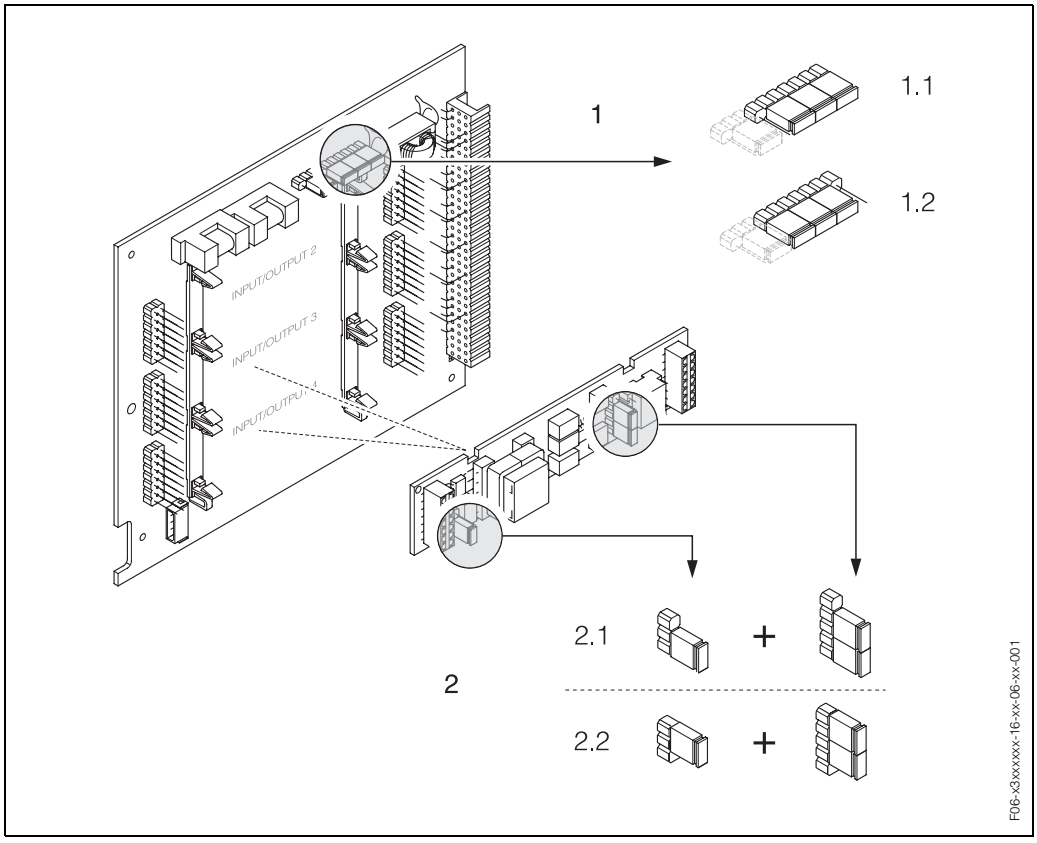


Fig. 35: Configuring current outputs with the aid of jumpers (I/O board)

1 Current output 1 with HART
1.1 Active current output (default)
1.2 Passive current output

2 Current output 2 (optional, plug-in module)
2.1 Active current output (default)
2.2 Passive current output

6.2.11 Current input: active/passive

The current outputs are configured as “active” or “passive” by means of various jumpers on the current input submodule.

Warning:
Risk of electric shock. Exposed components carry dangerous voltages. Make sure that the power supply is switched off before you remove the cover of the electronics compartment.

1. Switch off power supply.
2. Remove the I/O board → Page 104, 106
3. Set the jumpers in accordance with Fig. 36.

Caution:
– Risk of destroying the measuring device. Set the jumpers exactly as shown in Fig. 36. Incorrectly set jumpers can cause overcurrents that would destroy either the measuring device or external devices connected to it.
– Note that the position of the current submodule on the I/O board can vary, depending on the version ordered, and that the terminal assignment in the connection compartment of the transmitter varies accordingly → Page 29.

4. Installation of the I/O board is the reverse of the removal procedure.

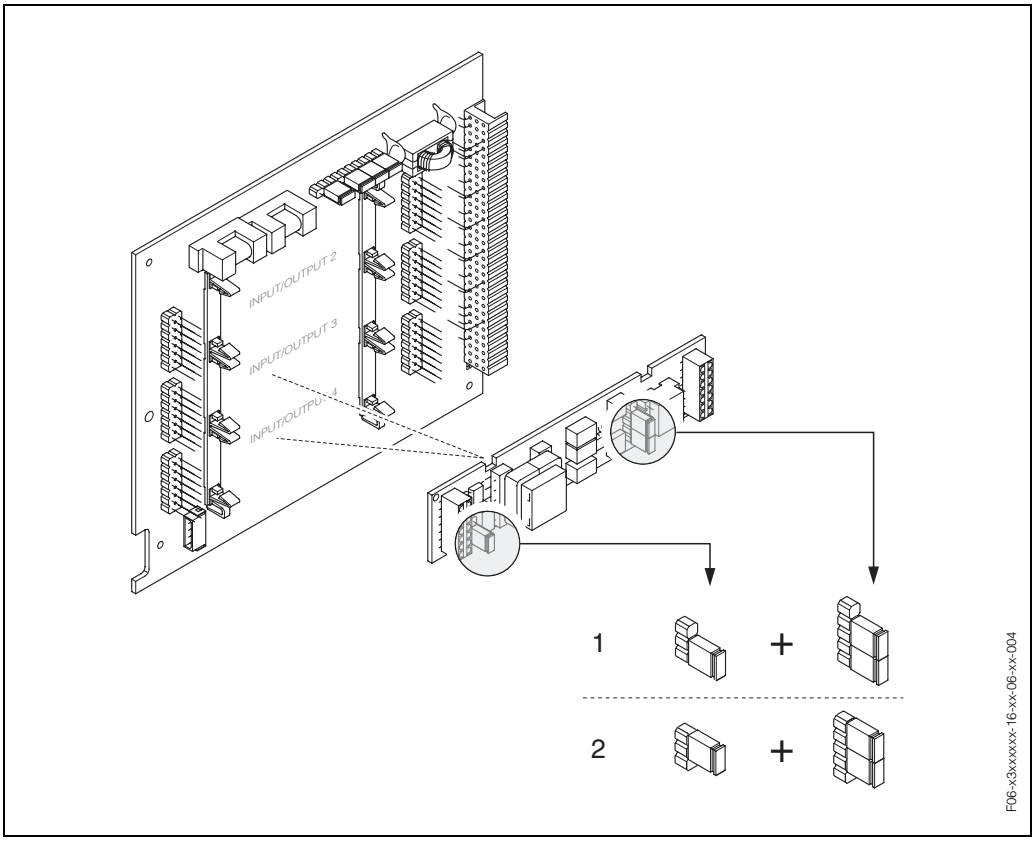


Fig. 36: Configuring current inputs with the aid of jumpers (I/O board)

Current input 1 (optional, plug-in module)
1 Active current input (default)
2 Passive current input

6.2.12 Relay contacts: Normally closed/Normally open

The relay contact can be configured as normally open (NO or make) or normally closed (NC or break) contacts by means of two jumpers on the I/O board or on the pluggable submodule. This configuration can be called up at any time with the “ACTUAL STATUS RELAY” function (No. 4740).

⚠ Warning:
Risk of electric shock. Exposed components carry dangerous voltages. Make sure that the power supply is switched off before you remove the cover of the electronics compartment.

1. Switch off power supply.
2. Remove the I/O board → Page 104, 106
3. Set the jumpers in accordance with Fig. 37.

☝ Caution:
– If you change the setting you must always change the positions of **both** jumpers. Note precisely the specified positions of the jumpers.
– Note that the position of the relay submodule on the I/O board can vary, depending on the version ordered, and that the terminal assignment in the connection compartment of the transmitter varies accordingly → see Page 29.

4. Installation of the I/O board is the reverse of the removal procedure.

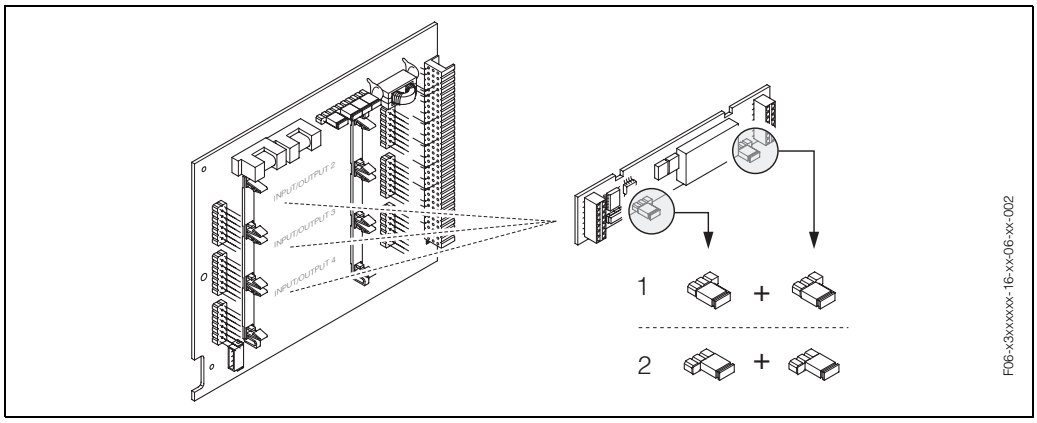


Fig. 37: Configuring relay contacts (NC / NO) on the convertible I/O board (submodule).

1 Configured as NO contact (default, relay 1)
2 Configured as NC contact (default, relay 2, if installed)

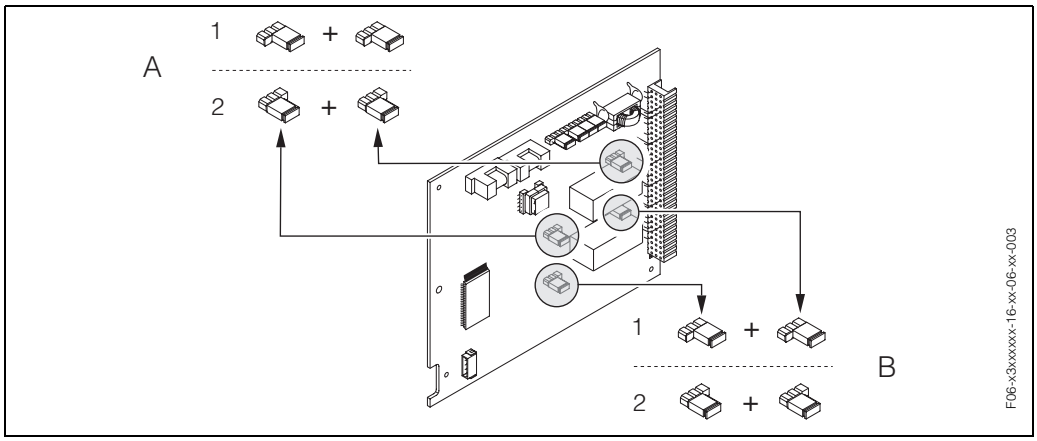


Fig. 38: Configuring relay contacts (NC / NO) on the non-convertible I/O board.
A = relay 1; B = relay 2

1 Configured as NO contact (default, relay 1)
2 Configured as NC contact (default, relay 2)

6.3 Purge and pressure monitoring connections

The sensor housing protects the inner electronics and mechanics and is filled with dry nitrogen. Beyond that, up to a specified measuring pressure it additionally serves as secondary containment.

Warning:
For a process pressure above the specified containment pressure, the housing does not serve as an additional secondary containment. In case a danger of measuring tube failure exists due to process characteristics, e.g. with corrosive process fluids, we recommend the use of sensors whose housing is equipped with special pressure monitoring connections (ordering option). With the help of these connections, fluid collected in the housing in the event of tube failure can be drained off. This diminishes the danger of mechanical overload of the housing, which could lead to a housing failure and accordingly is connected with an increased danger potential. These connections can also be used for gas purging (gas detection).

The following instructions apply to handling sensors with purge or pressure monitoring connections:
- Do not open the purge connections unless the containment can be filled immediately with a dry inert gas.
- Use only low gauge pressure to purge. Maximum pressure 5 bar.

6.4 Data storage device (DAT, F-Chip)

S-DAT (Sensor-DAT)
The S-DAT is an exchangeable data storage device in which all sensor relevant parameters are stored, i.e., diameter, serial number, calibration factor, zero point.

T-DAT (Transmitter-DAT)
The T-DAT is an exchangeable data storage device in which all transmitter parameters and settings are stored.
Storing of specific parameter settings from the EEPROM to the T-DAT and vice versa has to be carried out by the user (= **manual** save function). Detailed instructions regarding this can be found in the handbook “Description of Device Functions” (function “T-DAT SAVE/LOAD”, No. 1009).

F-Chip (Function-Chip)
The F-Chip is a microprocessor chip that contains additional software packages that extend the functionality and application possibilities of the transmitter.
In the case of a later upgrade, the F-Chip can be ordered as an accessory (see Page 87) and can simply be plugged on to the I/O board (see Page 103). After start up, the software is immediately made available to the transmitter.

Caution:
To ensure an unambiguous assignment, the F-Chip is coded with the transmitter serial number once it is plugged in. Thus, it can **not** be reused with other measuring devices.

7 Maintenance

The Promass 83 flow measuring system requires no special maintenance.

Exterior cleaning
When cleaning the exterior of measuring devices, always use cleaning agents that do not attack the surface of the housing and the seals.

Cleaning with pigs (Promass H, I)
If pigs are used for cleaning, it is essential to take the inside diameters of measuring tube and process connection into account (see Page 177 ff.).

Replacing seals
Under normal circumstances, fluid wetted seals of the Promass A and Promass M sensors do not require replacement. Replacement is necessary only in special circumstances, for example if aggressive or corrosive fluids are incompatible with the seal material.

Note:
- The period between changes depends on the fluid properties and on the frequency of cleaning cycles in the case of CIP/SIP cleaning.
- Replacement seals (accessories) → Page 87.

8 Accessories

Various accessories, which can be ordered separately from Endress+Hauser, are available for the transmitter and the sensor. The E+H service organisation can provide detailed information on the order codes of your choice.

Accessory	Description	Ordering code
Transmitter PROline Promass 83	Transmitter for replacement or for stock. Use the order code to define the following specifications: – Approvals – Degree of protection / version – Cable entries – Display / power supply / operation – Software – Outputs / inputs	83XXX – XXXXX * * * * * *
Inputs/outputs	Conversion kit with appropriate plug-in point modules for converting the input/output configuration in place to date to a new version.	DK8UI – * * * *
Software packages for Promass 83	Software add-ons on F-Chip, can be ordered individually: – Extended diagnosis – Batching functions – Concentration measurement	DK8SO – *
Installation set for transmitter	Mounting set for remote version. Suitable for: – Wall mounting – Pipe mounting – Installation in control panel	DK8WM – *
Post mounting set for the Promass A sensor	Post mounting set for the Promass A	DK8AS – * *
Mounting set for the Promass A sensor	Mounting set for Promass A, comprising: – 2 process connections (see Page 169 ff.) – Seals	DK8MS – * * * * * *
Set of seals for sensor	For regular replacement of the seals of the Promass M and Promass A sensors. Set consists of two seals.	DKS – * * *
HART Communicator DXR 375 handheld terminal	Handheld terminal for remote parameterisation and for obtaining measured values via the current output HART (4...20 mA). Contact your E+H representative for more information.	DXR375 – * * * * * *
Applicator	Software for selecting and configuring flowmeters. Applicator can be downloaded from the Internet or ordered on CD-ROM for installation on a local PC. Contact your E+H representative for more information.	DKA80 – *

Accessory	Description	Ordering code
FieldTool	Configuration and service software for flowmeters in the field: – Commissioning, maintenance analysis – Configuring flowmeters – Service functions – Visualisation of process data – Trouble-shooting – Controlling the “FieldCheck” tester/simulator Contact your E+H representative for more information.	DXS10 – * * * * *
FieldCheck	Tester/simulator for testing flowmeters in the field. When used in conjunction with the “FieldTool” software package, test results can be imported into a database, printed and used for official certification. Contact your E+H representative for more information.	DXC10 – * *

9 Trouble-shooting

9.1 Trouble-shooting instructions

Always start trouble-shooting with the checklists below, if faults occur after start-up or during operation. The routine takes you directly to the cause of the problem and the appropriate remedial measures.

Check the display	
No display visible and no output signals present.	1. Check the power supply → Terminals 1, 2 2. Check the power line fuse → Page 108 85...260 V AC: 0.8 A slow-blow / 250 V 20...55 V AC and 16...62 V DC: 2 A slow-blow / 250 V 3. Measuring electronics defective → order spare parts → Page 103
No display visible, but output signals are present.	1. Check whether the ribbon-cable connector of the display module is correctly plugged into the amplifier board → Page 105, 107 2. Display module defective → order spare parts → Page 103 3. Measuring electronics defective → order spare parts → Page 103
Display texts are in a foreign language.	Switch off power supply. Press and hold down both the ± keys and switch on the measuring device. The display text will appear in English (default) and is displayed at maximum contrast.
Measured value indicated, but no signal at the current or pulse output	Measuring electronics defective → order spare parts → Page 103

▼

Error messages on display	
Errors which occur during commissioning or measuring operation are displayed immediately. Error messages consist of a variety of icons. The meanings of these icons are as follows (example): – Error type: **S** = system error, **P** = process error – Error message type: ϟ = fault message, **!** = notice message – **MEDIUM INHOM.** = error designation, e.g. fluid is not homogeneous – **03:00:05** = duration of error occurrence (in hours, minutes and seconds) – **# 702** = error number ☞ Caution: • See the information on Page 42 ff.! • The measuring system interprets simulations and positive zero return as system errors, but displays them as notice message only.	
Error number: No. 001 – 399 No. 501 – 699	System error (device error) has occurred → Page 90
Error number: No. 400 – 499 No. 700 – 799	Process error (application error) has occurred → Page 98

▼

Other error (without error message)	
Some other error has occurred.	Diagnosis and rectification → Page 100

9.2 System error messages

Serious system errors are **always** recognised by the instrument as “Fault message”, and are shown as a lightning flash (ϟ) on the display. Fault messages immediately affect the inputs and outputs.
Simulations and positive zero return, on the other hand, are classed and displayed as “Notice messages”.

Caution:
In the event of a serious fault, a flowmeter might have to be returned to the manufacturer for repair. The procedures on Page 8 must be carried out before you return a flowmeter to Endress+Hauser.
Always enclose a duly completed “Declaration of contamination” form. You will find a preprinted blank of the this form at the back of this manual.

Note:
- The listed error message types below correspond to the factory setting.
- Also observe the information on Page 42 ff. and 101.

Type	Error message / No.	Cause	Remedy / spare part
S = System error ϟ = Fault message (with an effect on the outputs) ! = Notice message (without an effect on the outputs)			
No. # 0xx → Hardware error			
S ϟ	CRITICAL FAILURE **# 001**	Serious device error	Replace the amplifier board. Spare parts → Page 103
S ϟ	AMP HW EEPROM **# 011**	Amplifier: Defective EEPROM	Replace the amplifier board. Spare parts → Page 103
S ϟ	AMP SW EEPROM **# 012**	Amplifier: Error accessing EEPROM data	The EEPROM data blocks in which an error has occurred are displayed in the “TROUBLE-SHOOTING” function. Press Enter to acknowledge the errors in question; default values are automatically inserted instead of the errored parameter values. Note: The measuring device has to be restarted if an error has occurred in a totalizer block (see error No. 111 / CHECKSUM TOTAL.).
S ϟ	SENSOR HW DAT **# 031**	Sensor DAT: 1. S-DAT is defective. 2. S-DAT is not plugged into the amplifier board or is missing.	1. Replace the S-DAT. Spare parts → Page 103 Check the spare part set number to ensure that the new, replacement DAT is compatible with the measuring electronics. 2. Plug the S-DAT into the amplifier board → Page 105, 107

Type	Error message / No.	Cause	Remedy / spare part
S ϟ	SENSOR SW DAT **# 032**	Sensor DAT: Error accessing the calibration values stored in the S-DAT.	1. Check whether the S-DAT is correctly plugged into the amplifier board → Page 105, 107 2. Replace the S-DAT if it is defective. Spare parts → Page 103 Before replacing the DAT, check that the new, replacement DAT is compatible with the measuring electronics. Check the: – Spare part set number – Hardware revision code 3. Replace measuring electronics boards if necessary. Spare parts → Page 103
S ϟ	TRANSM. HW-DAT **# 041**	Transmitter DAT: 1. T-DAT is defective. 2. T-DAT is not plugged into the amplifier board or is missing.	1. Replace the T-DAT. Spare parts → Page 103 Check the spare part set number to ensure that the new, replacement DAT is compatible with the measuring electronics. 2. Plug the T-DAT into the amplifier board → Page 105, 107
S ϟ	TRANSM. SW-DAT **# 042**	Transmitter DAT: Error accessing the calibration values stored in the T-DAT.	1. Check whether the T-DAT is correctly plugged into the amplifier board → Page 105, 107 2. Replace the T-DAT if it is defective. Spare parts → Page 103 Before replacing the DAT, check that the new, replacement DAT is compatible with the measuring electronics. Check the: – Spare part set number – Hardware revision code 3. Replace measuring electronics boards if necessary. Spare parts → Page 103
S ϟ	A / C COMPATIB. **# 051**	The I/O board and the amplifier board are not compatible.	Use only compatible modules and boards. Check the compatibility of the modules used. Check the: – Spare part set number – Hardware revision code
S ϟ	HW F-CHIP **# 061**	Transmitter F-Chip: 1. F-Chip is defective. 2. F-Chip is not plugged into the I/O board or is missing.	1. Replace the F-Chip. Accessories → Page 87 2. Plug the F-Chip into the I/O board → Page 105, 107
No. # 1xx → Software error			
S ϟ	CHECKSUM TOTAL **# 111**	Totalizer checksum error	1. Restart the measuring device 2. Replace the amplifier board if necessary. Spare parts → Page 103

Type	Error message / No.	Cause	Remedy / spare part
S !	A / C COMPATIB. **# 121**	Due to different software versions, I/O board and amplifier board are only partially compatible (possibly restricted functionality). ✎ Note: – This message is only listed in the error history. – Nothing is displayed on the display.	Module with lower software version has either to be actualizied by FieldTool with the required software version or the module has to be replaced. Spare parts → Page 103
No. # 2xx → Error in DAT / no communication			
S !	LOAD T-DAT **# 205**	Transmitter DAT: Data backup (downloading) to T-DAT failed, or error when accessing (uploading) the calibration values stored in the T-DAT™.	1. Check whether the T-DAT is correctly plugged into the amplifier board, → Page 105 107 2. Replace the T-DAT if it is defective. Spare parts → Page 103 Before replacing the DAT, check that the new, replacement DAT is compatible with the measuring electronics. Check the: – Spare part set number – Hardware revision code 3. Replace measuring electronics boards if necessary. Spare parts → Page 103
S !	SAVE T-DAT **# 206**		
S ϟ	COMMUNIC. AMP. **# 251**	Internal communication fault on the amplifier board.	Remove the amplifier board. Spare parts → Page 103
S ϟ	COMMUNICATION I/O **# 261**	No data reception between amplifier and I/O board or faulty internal data transfer.	Check the BUS contacts
No. # 3xx → System limits exceeded (internal device error)			
S !	STACK CUR OUT n **# 339…342**	The temporarily buffered flow portions (measuring mode for pulsating flow) could not be cleared or output within 60 seconds.	1. Change the upper or lower limit setting, as applicable. 2. Increase or reduce flow, as applicable. Recommendations in the event of fault category = FAULT MESSAGE (ϟ): – Configure the fault response of the output to "ACTUAL VALUE" (see Page 101), so that the temporary buffer can be cleared. – Clear the temporary buffer by the measures described under Item 1.
S !	STACK FREQ. OUT n **# 343…346**		

Type	Error message / No.	Cause	Remedy / spare part
S **!**	STACK PULSE OUT n **# 347…350**	The temporarily buffered flow portions (measuring mode for pulsating flow) could not be cleared or output within 60 seconds.	1. Increase the setting for pulse weighting 2. Increase the max. pulse frequency, if the totalizer can handle a higher number of pulses. 3. Reduce flow Recommendations in the event of fault category = FAULT MESSAGE (ϟ): – Configure the fault response of the output to "ACTUAL VALUE" (see Page 101), so that the temporary buffer can be cleared. – Clear the temporary buffer by the measures described under Item 1.
S **!**	CURRENT RANGE **# 351...354**	Current output: Flow is out of range.	1. Change the upper or lower limit setting, as applicable. 2. Increase or reduce flow, as applicable.
S **!**	FREQ. RANGE **# 355...358**	Frequency output: Flow is out of range.	1. Change the upper or lower limit setting, as applicable. 2. Increase or reduce flow, as applicable.
S **!**	PULSE RANGE n **# 359…362**	Pulse output: Pulse output frequency is out of range.	1. Increase the setting for pulse weighting 2. When selecting the pulse width, choose a value that can still be processed by a connected counter (e.g. mechanical counter, PLC etc.). *Determine the pulse width:* – Variant 1: Enter the minimum duration that a pulse must be present at the connected counter to ensure its registration. – Variant 2: Enter the maximum (pulse) frequency as the half "reciprocal value" that a pulse must be present at the connected counter to ensure its registration. Example: The maximum input frequency of the connected counter is 10 Hz. The pulse width to be entered is: $\frac{1}{2 \cdot 10\ \text{Hz}} = 50\ \text{ms}$ 3. Reduce flow.
S **!**	RANGE CUR. IN **# 363**	Current input: The actual value for the current lies outside the set limits.	1. Change set lower-range or upper-range value. 1. Check settings of the external sensor.

Type	Error message / No.	Cause	Remedy / spare part
S ϟ	FREQ. LIM **# 379...380**	The measuring tube oscillation frequency is outside the permitted range. Causes: – Damaged measuring tube – Sensor defective or – damaged	Contact your E+H service organisation.
S ϟ	FLUIDTEMP.MIN. **# 381**	The temperature sensor on the measuring tube is likely defective.	Check the following electrical connections before you contact your E+H service organisation: – Verify that the sensor signal cable connector is correctly plugged into the amplifier board → Page 105, 107. – Remote version: Check sensor and transmitter terminal connections No. 9 and 10 → Page 25.
S ϟ	FLUIDTEMP.MAX. **# 382**	The temperature sensor on the measuring tube is likely defective.	Check the following electrical connections before you contact your E+H service organisation: – Verify that the sensor signal cable connector is correctly plugged into the amplifier board → Page 105, 107. – Remote version: Check sensor and transmitter terminal connections No. 9 and 10 → Page 25.
S ϟ	CARR.TEMP.MIN **# 383**	The temperature sensor on the carrier tube is likely defective.	Check the following electrical connections before you contact your E+H service organisation: – Verify that the sensor signal cable connector is correctly plugged into the amplifier board → Page 105, 107. – Remote version: Check sensor and transmitter terminal connections No. 11 and 12 → Page 25
S ϟ	CARR.TEMP.MAX **# 384**	The temperature sensor on the carrier tube is likely defective.	Check the following electrical connections before you contact your E+H service organisation: – Verify that the sensor signal cable connector is correctly plugged into the amplifier board → Page 105, 107. – Remote version: Check sensor and transmitter terminal connections No. 11 and 12 → Page 25

Type	Error message / No.	Cause	Remedy / spare part
S ϟ	INL.SENS.DEF. **# 385**	One of the measuring tube exciter coils (inlet) is likely defective.	Check the following electrical connections before you contact your E+H service organisation: – Verify that the sensor signal cable connector is correctly plugged into the amplifier board → Page 105, 107. – Remote version: Check sensor and transmitter terminal connections No. 4, 5, 6 and 7 → Page 25.
S ϟ	OUTL.SENS.DEF. **# 386**	One of the measuring tube exciter coils (outlet) is likely defective.	Check the following electrical connections before you contact your E+H service organisation: – Verify that the sensor signal cable connector is correctly plugged into the amplifier board → Page 105, 107. – Remote version: Check sensor and transmitter terminal connections No. 4, 5, 6 and 7 → Page 25.
S ϟ	SEN.ASY.EXCEED **# 387**	Measuring pipe excitation coil is probably faulty.	Check the following electrical connections before you contact your E+H service organisation: – Verify that the sensor signal cable connector is correctly plugged into the amplifier board → Page 105, 107. – Remote version: Check sensor and transmitter terminal connections No. 4, 5, 6 and 7 → Page 25.
S ϟ	AMP. FAULT **# 388 / 389 / 390**	Amplifier error	Contact your E+H service organisation.
No. # 5xx → Application error			
S **!**	SW.-UPDATE ACT. **# 501**	New amplifier or communication (I/O module) software version is loaded. Currently no other functions are possible.	Wait until process is finished. The device will restart automatically.
S **!**	UP-/DOWNLOAD ACT. **# 502**	Up- or downloading the device data via configuration program. Currently no other functions are possible.	Wait until process is finished.
S **!**	BATCH RUNNING **# 571**	Batching is started and active (valves are open)	No measures needed (during the batching process some other functions may not be activated).
S **!**	BATCH HOLD **# 572**	Batching has been interrupted (valves are closed)	1. Continue batching with command “GO ON”. 2. Interupt batching with “STOP” command.

Type	Error message / No.	Cause	Remedy / spare part
S ϟ	OSC. AMP. LIMIT **# 586**	The fluid properties do not allow a continuation of the measurement. Causes: – Extremely high viscosity – Process fluid is very inhomogeneous (gas or solid content)	Change or improve process conditions.
S ϟ	TUBE NOT OSC **# 587**	Extreme process conditions exist. The measuring system can therefore not be started.	Change or improve process conditions.
S ϟ	GAIN RED.IMPOS **# 588**	Overdriving of the internal analog to digital converter. Causes: – Cavitation – Extreme pressure pulses – High gas flow velocity A continuation of the measurement is no longer possible!	Change or improve process conditions, e.g. by reducing the flow velocity.
No. # 6xx → Simulation mode active			
S !	POSITIVE ZERO RETURN **# 601**	Positive zero return active. ☝ Caution: This message has the highest display priority.	Switch off positive zero return
S !	SIM. CURR. OUT. n **# 611…614**	Simulation current output active	Switch off simulation
S !	SIM. FREQ. OUT. n **# 621…624**	Simulation frequency output active	Switch off simulation
S !	SIM. PULSE n **# 631…634**	Simulation pulse output active	Switch off simulation
S !	SIM. STAT. OUT n **# 641…644**	Simulation status output active	Switch off simulation
S !	SIM. RELAY n **# 651…654**	Simulation relay output active	Switch off simulation
S !	SIM. STATUS IN **# 671…674**	Simulation status input active	Switch off simulation
S !	SIM. FAILSAFE **# 691**	Simulation of response to error (outputs) active	Switch off simulation
S !	SIM. MEASURAND **# 692…**	Simulation of measuring variables (e.g. mass flow)	Switch off simulation

Type	Error message / No.	Cause	Remedy / spare part
S **!**	DEV. TEST AKT. **# 698**	The measuring device is being checked on site via the test and simulation device.	–
No. # 8xx → Other error messages with software options (Coriolis flowmeter)			
S **!**	M. FL. DEV. LIMIT **# 800**	Advanced Diagnostics: The mass flow is outside the limit value, set in the corresponding diagnosis function.	–
S **!**	DENS. DEV. LIMIT **# 801**	Advanced Diagnostics: The density is outside the limit value, set in the corresponding diagnosis function.	–
S **!**	REF. D. DEV. LIM. **# 802**	Advanced Diagnostics: The reference density is outside the limit value, set in the corresponding diagnosis function.	–
S **!**	TEMP. DEV. LIMIT **# 803**	Advanced Diagnostics: The temperature is outside the limit value, set in the corresponding diagnosis function.	–
S **!**	T. DAMP. DEV. LIM **# 804**	Advanced Diagnostics: The tube damping is outside the limit value, set in the corresponding diagnosis function.	–
S **!**	E. D. SEN. DEV. LI **# 805**	Advanced Diagnostics: The electromagnetic sensor is outside limit value, set in the corresponding diagnosis function.	–

9.3 Process error messages

Process errors can be defined as either “Fault” or “Notice” messages and can thereby be weighted differently. Determination of this is done via the function matrix (see the “Description of Device Functions” Manual).

Note:
- The listed error message types below correspond to the factory setting.
- Also observe the information on Page 42 and 101.

Type	Error message / No.	Cause	Remedy
P = Process error ϟ = Fault message (with an effect on the outputs) ! = Notice message (without an effect on the outputs)			
No. # 4xx → Process limits exceeded			
P ϟ	> BATCH TIME **# 471**	The maximum permitted batching time was exceeded.	1. Increase flow rate 2. Check valve (opening) 3. Adjust time setting to changed batch quantity
P ϟ	>< BATCH QUANTITY **# 472**	– Underbatching: The minimum quantity was not reached. – Overbatching: The maximum permitted batching quantity was exceeded.	*Underbatching:* 1. Increase fixed correction quantity. 2. Valve closes too quickly with active after run correction. Enter smaller after run as mean value. 3. If the batching quantity changes, the minimum batching quantity must be adjusted. *Overbatching:* 1. Reduce fixed correction quantity. 2. Valve closes too slowly with active after run correction. Enter larger after run as mean value. 3. If the batching quantity changes, the maximum batching quantity must be adjusted.
P **!**	PROGRESS NOTE **# 473**	End of filling process approaching. The running filling process has exceeded the predefined batch quantity point for the display warning message.	No measures required (if necessary prepare to replace container).
No. #7xx → Other process errors			
P **!**	EMPTY PIPE **# 700**	The process fluid density is outside the upper or lower limit values set in the “EPD” function Causes: – Air in the measuring tube – Partly filled measuring tube	1. Ensure that there is no gas content in the process liquid. 2. Adapt the values in the “EPD” function to the current process conditions.

Type	Error message / No.	Cause	Remedy
P **!**	EXC. CURR. LIM **# 701**	The maximum current value for the measuring tube exciter coils has been reached, since certain process fluid characteristics are extreme, e.g. high gas or solid content. The instrument continues to work correctly.	In particular with outgassing fluids and/or increased gas content, the following measures are recommended to increase system pressure: 1. Install the instrument at the outlet side of a pump. 2. Install the instrument at the lowest point of an ascending pipeline. 3. Install a flow restriction, e.g. reducer or orifice, downstream from the instrument.
P **!**	FLUID INHOM. **# 702**	Frequency control is not stable, due to inhomogeneous process fluid, e.g. gas or solid content.	In particular with outgassing fluids and/or increased gas content, the following measures are recommended to increase system pressure: 1. Install the instrument at the outlet side of a pump. 2. Install the instrument at the lowest point of an ascending pipeline. 3. Install a flow restriction, e.g. reducer or orifice, downstream from the instrument.
P **!**	NOISE LIM. CH0 **# 703**	Overdriving of the internal analog to digital converter. Causes: – Cavitation – Extreme pressure pulses – High gas flow velocity A continuation of the measurement is still possible!	Change or improve process conditions, e.g. by reducing the flow velocity.
P **!**	NOISE LIM. CH1 **# 704**	Overdriving of the internal analog to digital converter. Causes: – Cavitation – Extreme pressure pulses – High gas flow velocity A continuation of the measurement is still possible!	Change or improve process conditions, e.g. by reducing the flow velocity.
P ↯	FLOW LIMIT **# 705**	The mass flow is too high. The electronics' measuring range will be exceeded.	Reduce flow
P **!**	ADJ. ZERO FAIL **# 731**	The zero point adjustment is not possible or has been cancelled.	Make sure that zero point adjustment is carried out at “zero flow” only (v = 0 m/s) → Page 71.

9.4 Process errors without messages

Symptoms	Rectification
Remark: You may have to change or correct certain settings of the function matrix in order to rectify faults. The functions outlined below, such as DISPLAY DAMPING, for example, are described in detail in the "Description of Device Functions" manual.	
Measured value reading fluctuates even though flow is steady.	1. Check the fluid for presence of gas bubbles. 2. "TIME CONSTANT" function → increase value (→ OUTPUTS / CURRENT OUTPUT / CONFIGURATION) 3. "DISPLAY DAMPING" function → increase value (→ USER INTERFACE / CONTROL / BASIC CONFIGURATION)
Flow values are negative, even though the fluid is flowing forwards through the pipe.	Change the setting in the "INSTALLATION DIRECTION SENSOR" function accordingly
Measured-value reading or measured-value output pulsates or fluctuates, e.g. because of reciprocating pump, peristaltic pump, diaphragm pump or pump with similar delivery characteristic.	Run the "Pulsating Flow" Quick Setup → Page 63 ff. If the problem persists despite these measures, a pulsation damper will have to be installed between pump and measuring device.
There are differences between the flowmeter's internal totalizer and the external metering device.	This symptom is due primarily to backflow in the piping, because the pulse output cannot subtract in the "STANDARD or SYMMETRY" measuring modes. The problem can be solved as follows: Allow for flow in both directions. Set the "MEASURING MODE" function to "Pulsating Flow" for the pulse output in question.
Measured value reading shown on display, even though the fluid is at a standstill and the measuring tube is full.	1. Check the fluid for presence of gas bubbles. 2. Activate the "ON-VAL. LF-CUTOFF" function, i.e. enter or increase the value for the creepage (→ BASIC FUNCTION / PROCESSPARAMETER / CONFIGURATION).
The fault cannot be rectified or some other fault not described above has occurred. In these instances, please contact your E+H service organisation.	The following options are available for tackling problems of this nature: **Request the services of an E+H service technician** If you contact our service organisation to have a service technician sent out, please be ready with the following information: – Brief description of the fault – Nameplate specifications (Page 9 ff.): Order code and serial number **Returning devices to E+H** The procedures on Page 8 must be carried out before you return a flowmeter requiring repair or calibration to Endress+Hauser. Always enclose a duly completed "Declaration of contamination" form with the flowmeter. You will find a preprinted "Declaration of contamination" form at the back of this manual. **Replace transmitter electronics** Components in the measuring electronics defective → order replacement → Page 103

9.5 Response of outputs to errors

Note:
The failsafe mode of totalizers, current, pulse and frequency outputs can be customised by means of various functions in the function matrix. You will find detailed information on these procedures in the “Description of Device Functions” manual.

Positive zero return and failsafe mode:
You can use positive zero return to set the signals of the current, pulse and frequency outputs to their fallback value, for example when measuring has to be interrupted while a pipe is being cleaned. This function takes priority over all other device functions. Simulations, for example, are suppressed.

Failsafe mode of outputs and totalizers

	Process/system error is present	Positive zero return is activated
Caution: System or process errors defined as “Information messages” have no effect whatsoever on the inputs and outputs. See the information on Page 42 ff.		
Current output	*MINIMUM CURRENT* The current output will be set to the lower value of the signal on alarm level depending on the setting selected in the CURRENT SPAN (see the “Description of Device Functions” manual). *MAXIMUM CURRENT* The current output will be set to the higher value of the signal on alarm level depending on the setting selected in the CURRENT SPAN (see the “Description of Device Functions” manual). *HOLD VALUE* Measured value display on the basis of the last saved value preceding occurrence of the fault. *ACTUAL VALUE* Measured value display on the basis of the current flow measurement. The fault is ignored.	Output signal corresponds to “zero flow”
Pulse output	*FALLBACK VALUE* Signal output → no pulses *HOLD VALUE* Last valid value (preceding occurrence of the fault) is output. *ACTUAL VALUE* Fault is ignored, i.e. normal measured value output on the basis of ongoing flow measurement.	Output signal corresponds to “zero flow”

Failsafe mode of outputs and totalizers		
	Process/system error is present	Positive zero return is activated
Frequency output	*FALLBACK VALUE* Signal output → 0 Hz *FAILSAFE LEVEL* Output of the frequency specified in the FAILSAFE VALUE function (No. 4211). *HOLD VALUE* Last valid value (preceding occurrence of the fault) is output. *ACTUAL VALUE* Fault is ignored, i.e. normal measured value output on the basis of ongoing flow measurement.	Output signal corresponds to "zero flow"
Totalizer	*STOP* The totalizers are paused until the error is rectified. *ACTUAL VALUE* The fault is ignored. The totalizers continue to count in accordance with the current flow value. *HOLD VALUE* The totalizers continue to count the flow in accordance with the last valid flow value (before the error occurred).	Totalizer stops
Relay output	In the event of a fault or power supply failure: Relay → deenergised The "Description of device Functions" manual contains detailed information on relay switching response for various configurations such as error message, flow direction, EPD, full scale value, etc.	No effect on the relay output

9.6 Spare parts

Section 9.1 contains a detailed trouble-shooting guide. The measuring device, moreover, provides additional support in the form of continuous self-diagnosis and error messages.
Fault rectification can entail replacing defective components with tested spare parts. The illustration below shows the available scope of spare parts.

Note:
You can order spare parts directly from your E+H service organisation by providing the serial number printed on the transmitter's nameplate (see Page 9).

Spare parts are shipped as sets comprising the following parts:
- Spare part
- Additional parts, small items (threaded fasteners, etc.)
- Mounting instructions
- Packaging

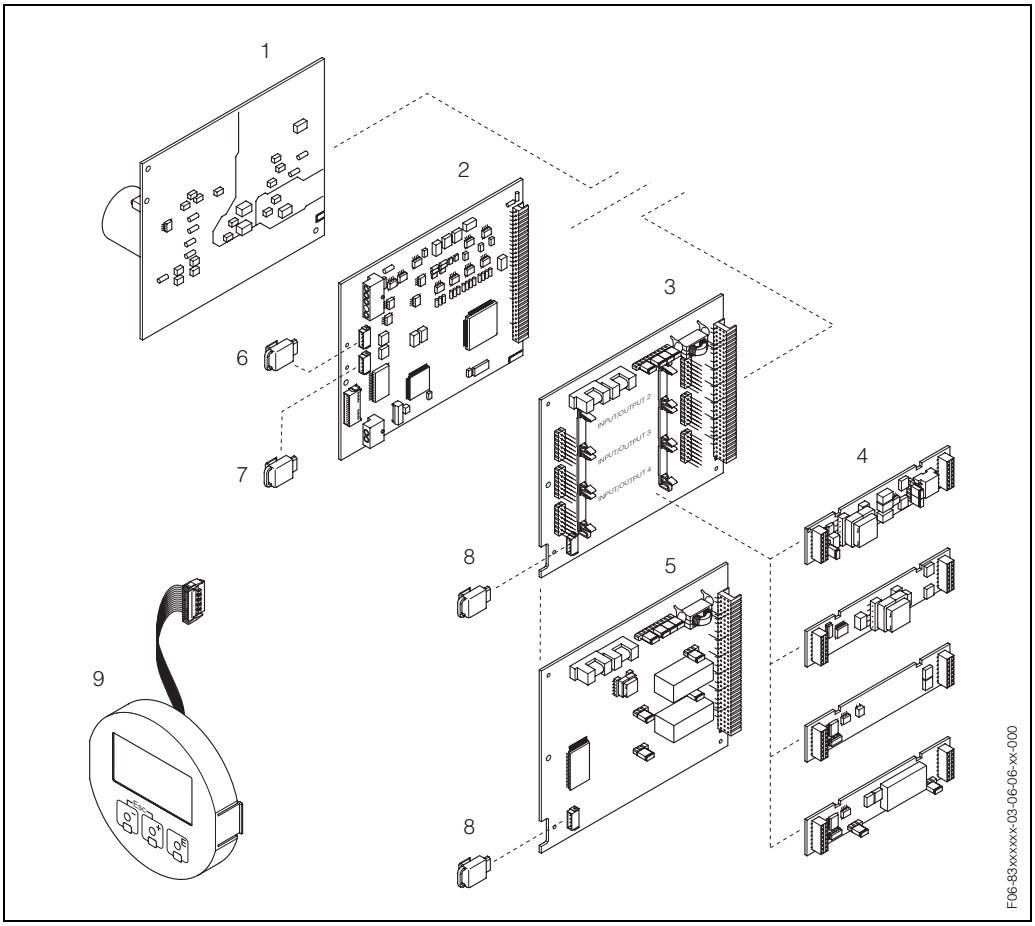


Fig. 39: Spare parts for Promass 83 transmitter (field and wall-mount housings)

1 Power unit board (85...260 V AC, 20...55 V AC, 16...62 V DC)
2 Amplifier board
3 I/O board (COM module), flexible assignment
4 Pluggable input/output submodules (ordering structure → Page 87)
5 I/O board (COM module), permanent assignment
6 S-DAT (sensor data memory)
7 T-DAT (transmitter data memory)
8 F-Chip (function chip for optional software)
9 Display module

9.7 Removing and installing printed circuit boards

Field housing: removing and installing printed circuit boards (Fig. 40)

Warning:
- Risk of electric shock. Exposed components carry dangerous voltages. Make sure that the power supply is switched off before you remove the cover of the electronics compartment.
- Risk of damaging electronic components (ESD protection). Static electricity can damage electronic components or impair their operability. Use a workplace with a grounded working surface purposely built for electrostatically sensitive devices!
- If you cannot guarantee that the dielectric strength of the device is maintained in the following steps, then an appropriate inspection must be carried out in accordance with the manufacturer's specifications.

1. Unscrew cover of the electronics compartment from the transmitter housing.
2. Remove the local display (1) as follows:
   – Press in the latches (1.1) at the side and remove the display module.
   – Disconnect the ribbon cable (1.2) of the display module from the amplifier board.
3. Remove the screws and remove the cover (2) from the electronics compartment.
4. Remove power unit board (4) and I/O board (6, 7):
   Insert a thin pin into the hole (3) provided for the purpose and pull the board clear of its holder.
5. Remove submodules (6.2):
   No tools are required for removing the submodules (inputs/outputs) from the I/O board. Installation is also a no-tools operation.

   Caution:
   Only certain combinations of submodules on the I/O board are permissible (see Page 29). The individual slots are marked and correspond to certain terminals in the connection compartment of the transmitter:

   "INPUT / OUTPUT 2" slot = terminals 24 / 25
   "INPUT / OUTPUT 3" slot = terminals 22 / 23
   "INPUT / OUTPUT 4" slot = terminals 20 / 21

6. Remove amplifier board (5):
   – Disconnect the plug of the sensor signal cable (5.1) including S-DAT (5.3) from the board.
   – Gently disconnect the plug of the excitation current cable (5.2) from the board, i.e. without moving it back and forward.
   – Insert a thin pin into the hole (3) provided for the purpose and pull the board clear of its holder.
7. Installation is the reverse of the removal procedure.

   Caution:
   Use only original Endress+Hauser parts.

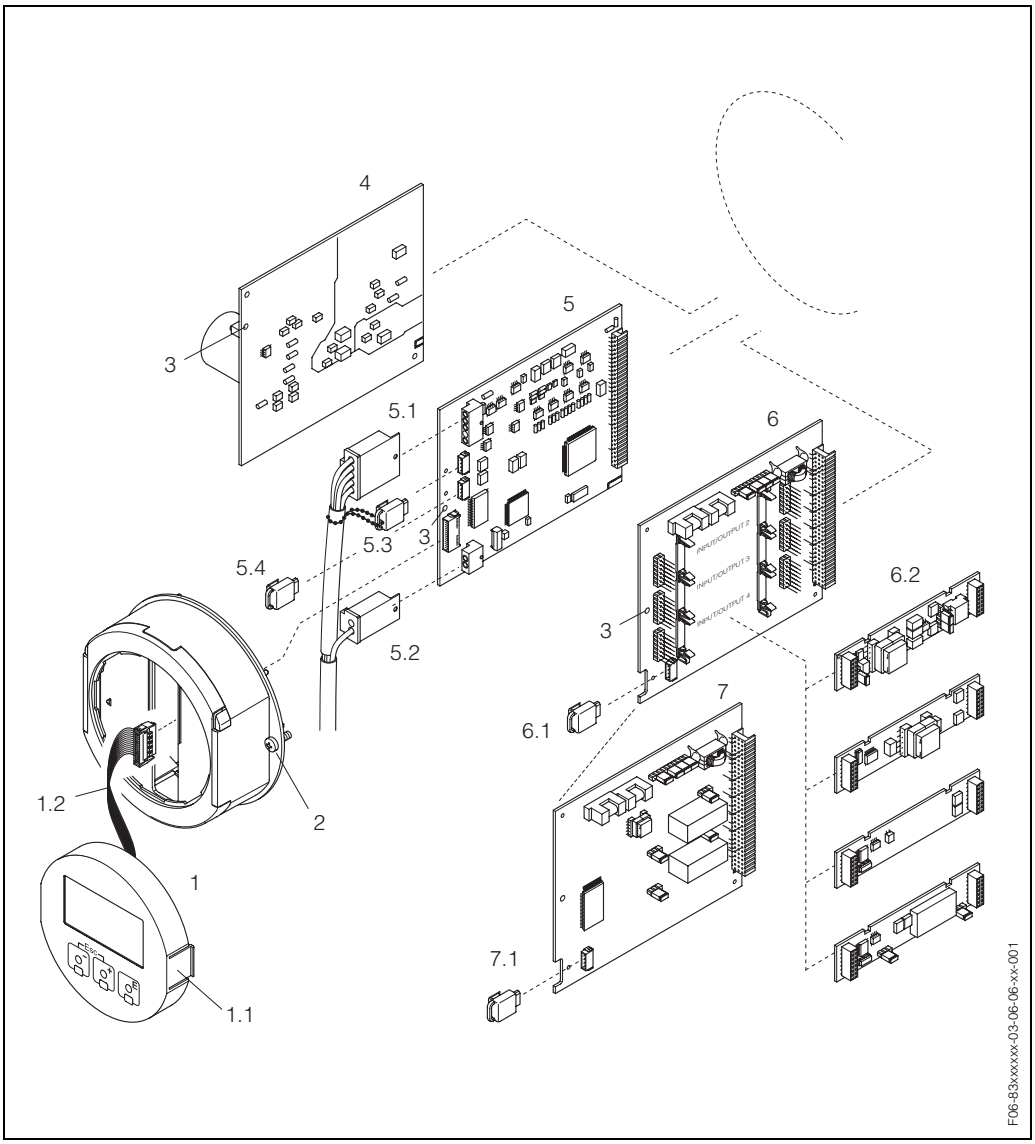


Fig. 40: Field housing: removing and installing printed circuit boards

1 Local display
1.1 Latch
1.2 Ribbon cable (display module)
2 Screws of electronics compartment cover
3 Aperture for installing/removing boards
4 Power unit board
5 Amplifier board
5.1 Signal cable (sensor)
5.2 Excitation current cable (sensor)
5.3 S-DAT (sensor data memory)
5.4 T-DAT (transmitter data memory)
6 I/O board (flexible assignment)
6.1 F-Chip (function chip for optional software)
6.2 Pluggable submodules (status input and current input, current output, frequency output and relay output)
7 I/O board (permanent assignment)
7.1 F-Chip (function chip for optional software)

Wall-mount housing: removing and installing printed circuit boards (Fig. 41)

Warning:
- Risk of electric shock. Exposed components carry dangerous voltages. Make sure that the power supply is switched off before you remove the cover of the electronics compartment.
- Risk of damaging electronic components (ESD protection). Static electricity can damage electronic components or impair their operability. Use a workplace with a grounded working surface, purposely built for electrostatically sensitive devices!

1. Remove the screws and open the hinged cover (1) of the housing.
2. Remove the screws securing the electronics module (2). Then push up electronics module and pull it as far as possible out of the wall-mount housing.
3. Disconnect the following cable plugs from amplifier board (7):
   – Sensor signal cable plug (7.1) including S-DAT (7.3)
   – Unplug excitation current cable (7.2). Gently disconnect the plug, i.e. without moving it back and forward.
   – Ribbon cable plug (3) of the display module.
4. Remove the cover (4) from the electronics compartment by losening the screws.
5. Remove the boards (6, 7, 8, 9):
   Insert a thin pin into the hole (5) provided for the purpose and pull the board clear of its holder.
6. Remove submodules (8.2):
   No tools are required for removing the submodules (inputs/outputs) from the I/O board. Installation is also a no-tools operation.

   Caution:
   Only certain combinations of submodules on the I/O board are permissible (see Page 29). The individual slots are marked and correspond to certain terminals in the connection compartment of the transmitter:

   “INPUT / OUTPUT 2” slot = terminals 24 / 25
   “INPUT / OUTPUT 3” slot = terminals 22 / 23
   “INPUT / OUTPUT 4” slot = terminals 20 / 21

7. Installation is the reverse of the removal procedure.

   Caution:
   Use only original Endress+Hauser parts.

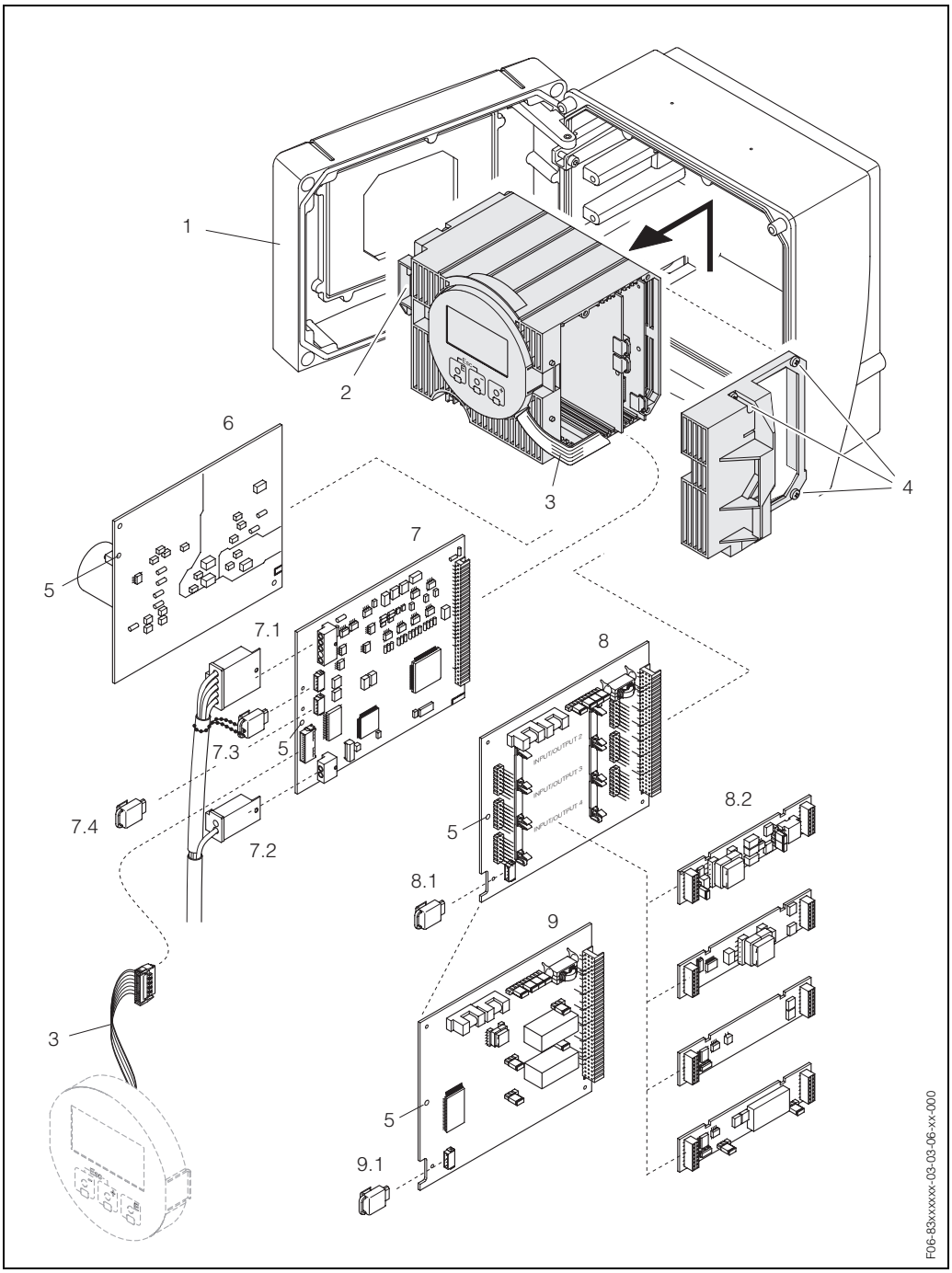


Fig. 41: Wall-mount housing: removing and installing printed circuit boards

1 Housing cover
2 Electronics module
3 Ribbon cable (display module)
4 Screws of electronics compartment cover
5 Aperture for installing/removing boards
6 Power unit board
7 Amplifier board
7.1 Signal cable (sensor)
7.2 Excitation current cable (sensor)
7.3 S-DAT (sensor data memory)
7.4 T-DAT (transmitter data memory)
8 I/O board (flexible assignment)
8.1 F-Chip (function chip for optional software)
8.2 Pluggable submodules (status input and current input, current output, frequency output and relay output)
9 I/O board (permanent assignment)
9.1 F-Chip (function chip for optional software)

9.8 Replacing the device fuse

⚠ Warning:
Risk of electric shock. Exposed components carry dangerous voltages. Make sure that the power supply is switched off before you remove the cover of the electronics compartment.

The main fuse is on the power unit board (Fig. 42).
The procedure for replacing the fuse is as follows:

1. Switch off power supply.
2. Remove the power unit board → Page 104, 106
3. Remove cap (1) and replace the device fuse (2).
   Use only fuses of the following type:
   – Power supply 20...55 V AC / 16...62 V DC → 2.0 A slow-blow / 250 V; 5.2 x 20 mm
   – Power supply 85...260 V AC → 0.8 A slow-blow / 250 V; 5.2 x 20 mm
   – Ex-rated devices → see the Ex documentation.
4. Assembly is the reverse of the disassembly procedure.

☝ Caution:
Use only original Endress+Hauser parts.

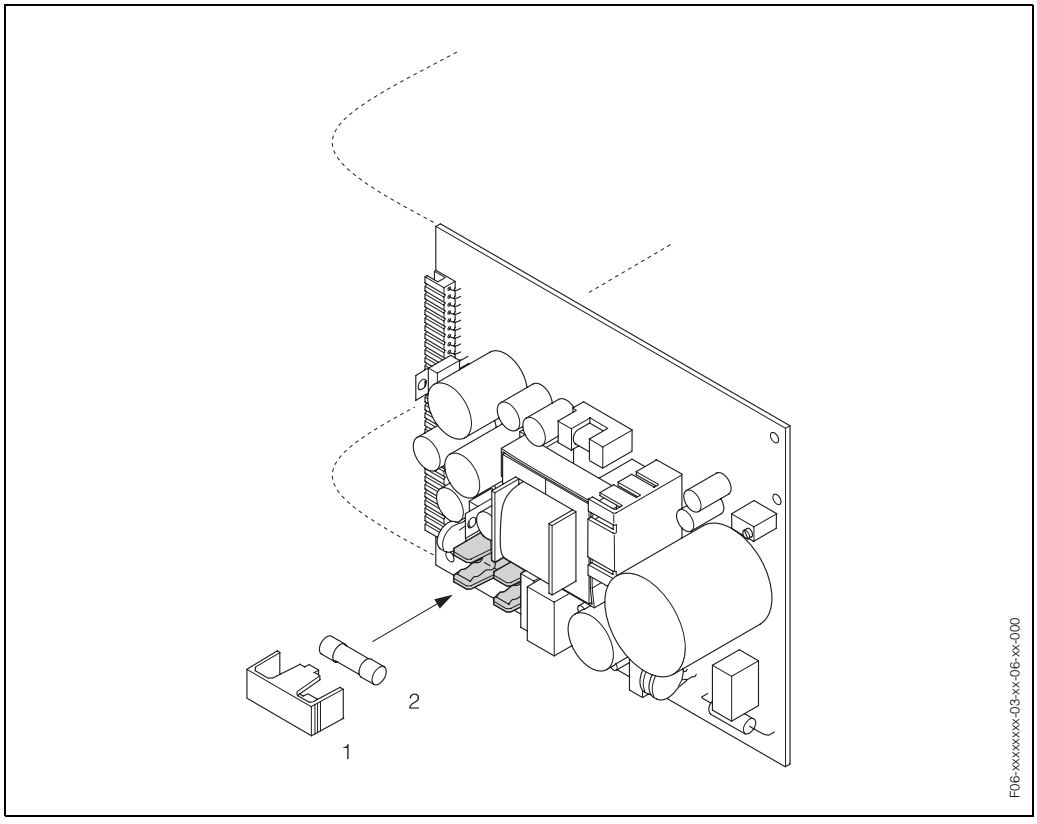


Fig. 42: Replacing the device fuse on the power unit board

1 Protective cap
2 Device fuse

9.9 Software history

Software version / date	Changes to software	Changes to documentation
Amplifier		
V 1.00.XX / 11.2000	Original software Compatible with: – FieldTool – HART communicator DXR 275 (OS 4.6 and higher) with rev. 1, DD 1.	–
V 1.01.00 / 03.2001 V 1.01.01 / 05.2001	Software adaptation	–
V 1.02.00 / 06.2001	Software expansion: New functionalities	• General instrument functions • "Batching" software function • "Concentration measurement" software function • "Advanced Diagnostics" software function • HART operating via Universal Commands and Common Practice Commands
V 1.02.01 / 11.2001	Software adaptation	–
V 1.02.02 / 04.2002	Software expansion	Promass H
v 1.04.xx / 08.2002	Software expansion	Promass E
V 1.05.xx / 03.2003	Software adaptation	–
V 1.06.xx / 10.2003	Software expansion New functionalities Compatible with:	• Language groups • Flow direction pulse output selectable • Adjustments to FieldCheck and Simubox • Concentration measurement with 4 data records • Viscosity measurement with temperature compensation • Acquisition start via status input for advanced diagnostics • Operation hours counter • Intensity of background illumination adjustable • Simulation pulse output • Counter for access code • ToF-Tool FieldTool package (the latest SW version can be downloaded under: www.tof-field-tool.endress.com • HART Communicator DXR 375 with Device Rev. 5, DD Rev. 1

Communication (I/O)		
V 1.00.00 / 11.2000	Original software	–
V 1.02.00 / 06.2001	Software expansion: New functionalities:	• “Batching” software function • “Pulse width” software function
V 1.02.01 / 03.2003	Software adaptation	–
V 1.03.00 / 10.2003	Software expansion: New functionalities:	• SIL 2 • Current input • Simulation pulse output

Note:
Up or downloading a software version normally requires a special service software.

10 Technical data

10.1 Technical data at a glance

10.1.1 Applications

The measuring device is for mass flow and volume flow measurement of liquids and gases in sealed piping systems. Application examples:

- Chocolate, condensed milk, liquid sugar
- Oils, fats
- Acids, alkalis, lacquers, paints, solvents and cleaning agents
- Pharmaceuticals, catalysts, inhibitors
- Suspensions
- Gases, liquefied gases, etc.

10.1.2 Function and system design

Measuring principle

Mass flow measurement by the Coriolis principle

Measuring system

The measuring system consists of a transmitter and a sensor:
- Promass 83 transmitter
- Promass F, M, E, A, H or I sensor

Two versions are available:
- Compact version: transmitter and sensor form a single mechanical unit.
- Remote version: transmitter and sensor are installed separately.

10.1.3 Input

Measured variable

- Mass flow (proportional to the phase difference between two sensors mounted on the measuring tube to register a phase shift in the oscillation)
- Fluid density (proportional to resonance frequency of the measuring tube)
- Fluid temperature (measured with temperature sensors)

Measuring range

Measuring ranges for liquids (Promass F, M, E):

DN	Range of full scale values (liquids) $\dot{m}_{min(F)} \cdots \dot{m}_{max(F)}$
8	0...2000 kg/h
15	0...6500 kg/h
25	0...18000 kg/h
40	0...45000 kg/h
50	0...70000 kg/h
80 *	0...180000 kg/h
100 **	0...350000 kg/h
150 **	0...800000 kg/h

* Promass F, M only
** Promass F only

Measuring ranges for liquids (Promass A):

DN	Range of full scale values (liquids) $\dot{m}_{min(F)} \dots \dot{m}_{max(F)}$
1	0...20 kg/h
2	0...100 kg/h
4	0...450 kg/h

Measuring ranges for liquids (Promass H, I):

DN	Range of full scale values (liquids) $\dot{m}_{min(F)} \dots \dot{m}_{max(F)}$
8	0...2000 kg/h
15	0...6500 kg/h
15 *	0...18000 kg/h
25	0...18000 kg/h
25 *	0...45000 kg/h
40	0...45000 kg/h
40 *	0...70000 kg/h
50	0...70000 kg/h
* DN 15, 25, 40 “FB” = Full bore versions of Promass I	

Measuring ranges for gases (except Promass H):
The full scale values depend on the density of the gas. Use the formula below to calculate the full scale values:

$$\dot{m}_{max(G)} = \dot{m}_{max(F)} \cdot \rho_{(G)} \frac{1}{x\ [kg/m^3]}$$

$\dot{m}_{max(G)}$ = Max. full scale value for gas [kg/h]
$\dot{m}_{max(F)}$ = Max. full scale value for liquid [kg/h]
$\rho_{(G)}$ = Gas density in [kg/m^3] at operating conditions
x = 160 (Promass F DN 8...100, M, I); x = 250 (Promass F DN 150); x = 225 (Promass E); x = 32 (Promass A)

In doing so $\dot{m}_{max(G)}$ will never exceed $\dot{m}_{max(F)}$.

Calculation example for gas:
- Sensor type: Promass F, DN 50
- Gas: air with a density of 60.3 kg/m^3 (at 20 °C and 50 bar)
- Measuring range: 70000 kg/h
- x = 160 (for Promass F DN 50)

Max. possible full scale value:

$$\dot{m}_{max(G)} = \frac{\dot{m}_{max(F)} \cdot \rho_{(G)}}{x\ [kg/m^3]} = \frac{70000\,kg/h \cdot 60.3\,kg/h}{160\,kg/m^3} = 26400\ kg/h$$

Recommended measuring ranges:
See Page 120 ff. (“Limiting flow”)

Operable flow range

Greater than 1000 : 1. Flows above the preset full scale value do not overload the amplifier, i.e. totalizer values are registered correctly.

Input signal	Status input (auxiliary input): U = 3...30 V DC, R_i = 5 kΩ, galvanically isolated. Configurable for: totalizer(s) reset, positive zero return, error message reset, zero point adjustment. Current input: active/passive selectable, galvanically isolated, resolution: 2 µA active: 4...20 mA, $R_i \leq 150$ Ω, U_{out} = 24 V DC, short-circuit proof passive: 0/4...20 mA, $R_i \leq 150$ Ω, U_{max} = 30 V DC

10.1.4 Output

Output signal	Current output: Active/passive selectable, galvanically isolated, time constant selectable (0.05...100 s), full scale value selectable, temperature coefficient: typically 0.005% o.f.s./ °C; resolution: 0.5 µA • active: 0/4...20 mA, $R_L < 700$ Ω (for HART: $R_L \geq 250$ Ω) • passive: 4...20 mA; supply voltage V_S 18...30 V DC; $R_L \leq 700$ Ω Pulse / frequency output: active/passive selectable, galvanically isolated • active: 24 V DC, 25 mA (max. 250 mA during 20 ms), $R_L > 100$ Ω • passive: open collector, 30 V DC, 250 mA • Frequency output: full scale frequency 2...10000 Hz (f_{max} = 12500 Hz), on/off ratio 1:1, pulse width max. 2 s • Pulse output: pulse value and pulse polarity selectable, pulse width configurable (0.05…2000 ms)
Signal on alarm	• Current output → failsafe mode selectable (for example, according to NAMUR recommendation NE 43) • Pulse/frequency output → failsafe mode selectable • Relay output → de-energised by fault or power supply failure
Load	see “Output signal”
Switching output	Relay output: Normally closed (NC or break) or normally open (NO or make) contacts available (default: relay 1 = NO, relay 2 = NC), max. 30 V / 0.5 A AC; 60 V / 0.1 A DC, galvanically isolated. Configurable for: error messages, Empty Pipe Detection (EPD), flow direction, limit values.
Low flow cutoff	Switch points for low flow cut off are selectable
Galvanic isolation	All circuits for inputs, outputs, and power supply are galvanically isolated from each other.

10.1.5 Auxiliary energy

Electrical connections	see Page 25 ff.
Supply voltage	85...260 V AC, 45...65 Hz 20...55 V AC, 45...65 Hz 16...62 V DC
Cable entry	Power supply and signal cables (inputs/outputs): • Cable entry M20 x 1.5 (8...12 mm) • Threads for cable entries, PG 13.5 (5...15 mm), 1/2" NPT, G 1/2" Connecting cable for remote version: • Cable entry M20 x 1.5 (8...12 mm) • Threads for cable entries, PG 13.5 (5...15 mm), 1/2" NPT, G 1/2"
Cable specifications (remote version)	• 6 x 0.38 mm^2 PVC cable with common shield and individually shielded cores. • Conductor resistance: ≤ 50 Ω/km • Capacitance: core/shield: ≤ 420 pF/m • Cable length: max. 20 m • Permanent operating temperature: max. +105 °C
Power consumption	AC: <15 VA (including sensor) DC: <15 W (including sensor) Switch-on current: • max. 13.5 A (< 50 ms) at 24 V DC • max. 3 A (< 5 ms) at 260 V AC
Power supply failure	Lasting min. 1 power cycle: • EEPROM or T-DAT saves measuring system data if power supply fails. • S-DAT: exchangeable data storage chip which stores the data of the sensor (nominal diameter, serial number, calibration factor, zero point, etc.)
Potential equalisation	No measures necessary

10.1.6 Performance characteristics

Reference operating conditions

Error limits following ISO/DIS 11631:
- 20...30 °C; 2...4 bar
- Calibration systems as per national norms
- Zero point calibrated under operating conditions
- Field density calibrated (or special density calibration)

Maximum measured error

The following values refer to the pulse/frequency output.
Deviation at the current output is typically ±5 µA.

Mass flow (liquid)

Promass F, M, A: ±0.10% ± [(zero point stability / measured value) x 100]% o.r.
Promass E: ±0.30% ± [(zero point stability / measured value) x 100]% o.r.
Promass H, I: ±0.15% ± [(zero point stability / measured value) x 100]% o.r.

Mass flow (gas)

Promass F: ±0.35% ± [(zero point stability / measured value) x 100]% o.r.
Promass M, A, I: ±0.50% ± [(zero point stability / measured value) x 100]% o.r.
Promass E: ±0.75% ± [(zero point stability / measured value) x 100]% o.r.

Volume flow (liquid)

Promass F: ±0.15% ± [(zero point stability / measured value) x 100]% o.r.
Promass M, A: ±0.25% ± [(zero point stability / measured value) x 100]% o.r.
Promass E: ±0.45% ± [(zero point stability / measured value) x 100]% o.r.
Promass H, I: ±0.50% ± [(zero point stability / measured value) x 100]% o.r.

o.r. = of reading

Zero point stability (Promass F, M, E):

DN	Max. full scale value [kg/h] or [l/h]	Zero point stability Promass F [kg/h] or [l/h]	Zero point stability Promass F (high-temperature version) [kg/h] or [l/h]	Zero point stability Promass M [kg/h] or [l/h]	Zero point stability Promass E [kg/h] or [l/h]
8	2000	0.100	–	0.100	0.200
15	6500	0.325	–	0.325	0.650
25	18000	0.90	1.80	0.90	1.80
40	45000	2.25	–	2.25	4.50
50	70000	3.50	7.00	3.50	7.00
80	180000	9.00	18.00	9.00	–
100	350000	14.00	–	–	–
150	800000	32.00	–	–	–

Zero point stability (Promass A):

DN	Maximum full scale value [kg/h] or [l/h]	Zero point stability [kg/h] or [l/h]
1	20	0.0010
2	100	0.0050
4	450	0.0225

Zero point stability (Promass H, I):

DN	**Maximum full scale value** [kg/h] or [l/h]	**Zero point stability Promass H** [kg/h] or [l/h]	**Zero point stability Promass I** [kg/h] or [l/h]
8	2000	0.20	0.20
15	6500	0.65	0.65
15 *	18000	–	1.8
25	18000	1.8	1.8
25 *	45000	–	4.5
40	45000	4.5	4.5
40 *	70000	–	7.0
50	70000	7.0	7.0
* DN 15, 25, 40 “FB” = Full bore versions of Promass I			

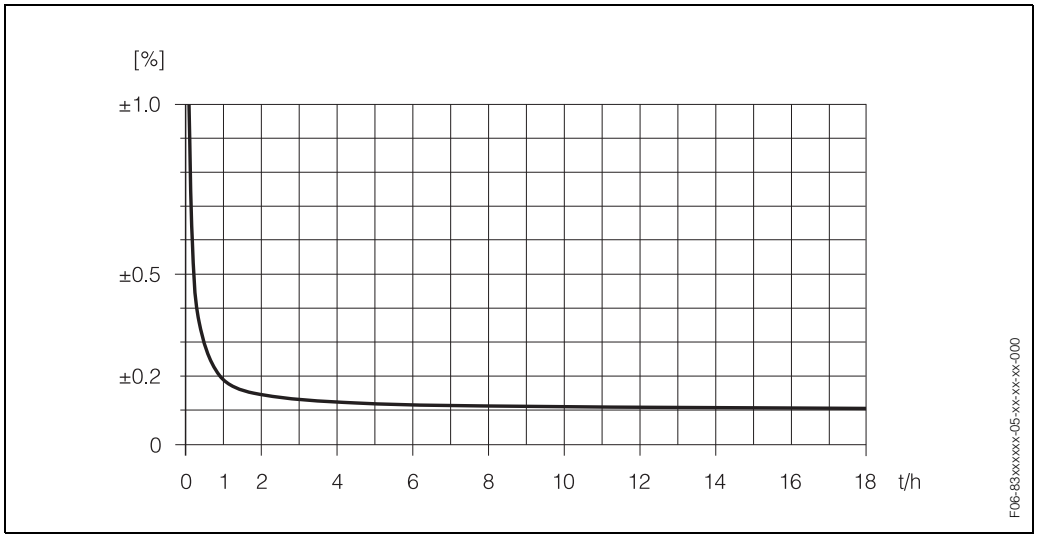


Fig. 43: Maximum measured error in % of reading (example: Promass 83 F / DN 25)

Calculation example (mass flow, liquid):
Given: Promass 83 F / DN 25, flow = 8000 kg/h
Max. measured error: ±0.10% ± [(zero point stability / measured value) x 100]% o.r.

$$\text{Max. measured error} \rightarrow \pm 0.10\% \pm \frac{0.9 \text{ kg/h}}{8000 \text{ kg/h}} \cdot 100\ \% = \pm 0.111\%$$

Density (liquid)
- After field density calibration or under reference conditions:
  Promass F: ±0.0005 g/cc
  Promass M, E, A, H: ±0.0010 g/cc
  Promass I: ±0.0020 g/cc

- Special density calibration (optional), not for high-temperature version.
  Calibration range = 0.8...1.8 g/cc, 5...80 °C:
  Promass F: ±0.001 g/cc
  Promass M, A, H: ±0.002 g/cc
  Promass I: ±0.004 g/cc

- Standard calibration:
  Promass F: ±0.01 g/cc
  Promass M, E, A, H, I: ±0.02 g/cc

Temperature
±0.5 °C ±0.005 x T (T = fluid temperature in °C)

Repeatability

Flow measurement
- Mass flow (liquid):
  Promass F, M, A, H, I: ±0.05% ± [1/2 x (zero point stability / measured value) x 100]% o.r.
  Promass E: ±0.15% ± [1/2 x (zero point stability / measured value) x 100]% o.r.
- Mass flow (gas):
  Promass F, M, A, I: ±0.25% ± [1/2 x (zero point stability / measured value) x 100]% o.r.
  Promass E: ±0.35% ± [1/2 x (zero point stability / measured value) x 100]% o.r.
- Volume flow (liquid):
  Promass F: ±0.05% ± [1/2 x (zero point stability / measured value) x 100]% o.r.
  Promass M, A: ±0.10% ± [1/2 x (zero point stability / measured value) x 100]% o.r.
  Promass E: ±0.25% ± [1/2 x (zero point stability / measured value) x 100]% o.r.
  Promass A: ±0.10% ± [1/2 x (zero point stability / measured value) x 100]% o.r.
  Promass H, I: ±0.20% ± [1/2 x (zero point stability / measured value) x 100]% o.r.

o.r. = of reading
Zero point stability: see “Max. measured error”

Calculation example (mass flow, liquid):
Given: Promass 83 F / DN 25, flow = 8000 kg/h
Repeatability: ±0.05% ± [1/2 x (zero point stability / measured value) x 100]% o.r.

$$\text{Repeatability} \rightarrow \pm 0.05\% \pm 1/2 \cdot \frac{0.9 \text{ kg/h}}{8000 \text{ kg/h}} \cdot 100\ \% = \pm 0.0556\%$$

Density measurement (liquid)
Promass F: ±0.00025 g/cc (1 g/cc = 1 kg/l)
Promass M, H, E, A: ±0.0005 g/cc
Promass I: ±0.001 g/cc

Temperature measurement
±0.25 °C ±0.0025 x T (T = fluid temperature in °C)

Influence of medium temperature

When there is a difference between the temperature for zero point adjustment and the process temperature, the typical measured error of the Promass sensor is ±0.0002% of the full scale value / °C. The typical measured error of the Promass E sensor is ±0.0003% of the full scale value / °C.

Influence of medium pressure

The tables below show the effect on accuracy of mass flow due to a difference between calibration pressure and process pressure.

Promass F, M:

DN	**Promass F/ Promass F (high-temperature)** % o.r. / bar	**Promass M** % o.r. / bar	**Promass M / (high pressure)** % o.r. / bar
8	No influence	0.009	0.006
15	No influence	0.008	0.005
25	No influence	0.009	0.003
40	–0.003	0.005	–
50	–0.008	No influence	–
80	–0.009	No influence	–
100	–0.012	–	–
150	–0.009	–	–
o.r. = of reading			

Promass H, I:

DN	**Promass H** % o.r. / bar	**Promass I** % o.r. / bar
8	–0.017	0.006
15	–0.021	0.004
15 [1)]	–	0.006
25	–0.013	0.006
25 [1)]	–	No influence
40	–0.018	No influence
40 [1)]	–	0.006
50	–0.020	0.006
[1)] DN 15, 25, 40 “FB” = Full bore versions of Promass I		

Promass E:
With nominal diameters DN 8...40, the effect on accuracy of mass flow due to a difference between calibration pressure and process pressure can be neglected.

With DN 50 the influence is –0.009% o.r. / bar (o.r. = of reading)

Promass A:
A difference between calibration pressure and process pressure has no effect on measuring accuracy.

10.1.7 Operating conditions

	Installation
Installation instructions	see Page 14 ff.
Inlet and outlet runs	There are no installation requirements regarding inlet and outlet runs.
Length of connecting cable	Max. 20 meters (remote version)
System pressure	see Page 15
	Environment
Ambient temperature	Standard: –20...+60 °C (sensor, transmitter) Optional: –40...+60 °C (sensor, transmitter) Note! • Install the device at a shady location. Avoid direct sunlight, particularly in warm climatic regions. • At ambient temperatures below –20 °C the readability of the display may be impaired.
Storage temperature	–40...+80 °C (preferably +20 °C)
Degree of protection	Standard: IP 67 (NEMA 4X) for transmitter and sensor
Shock resistance	According to IEC 68-2-31
Vibration resistance	Acceleration up to 1 g, 10...150 Hz, following IEC 68-2-6
Suitability for CIP cleaning	yes
Suitability for SIP cleaning	yes
Electromagnetic compatibility (EMC)	To EN 61326/A1 and NAMUR recommendation NE 21
	Process
Medium temperature range	Sensor: • Promass F, A, H: –50...+200 °C • Promass F: –50...+350 °C (high-temperature version) • Promass M, I: –50...+150 °C • Promass E: –40...+125 °C Seals: • Promass F, E, H, I: no internal seals • Promass M: Viton –15...200 °C; EPDM –40...+160 °C; silicon –60...+200 °C; Kalrez –20...+275 °C; FEP-jacketed (not for gas applications): –60...+200 °C • Promass A (only for mounting sets with threaded connections): Viton –15...200 °C; EPDM –40...+275 °C; silicon –60...+200 °C; Kalrez –20...+275 °C

Limiting medium pressure range (rated pressure)

The material load curves (pressure-temperature diagrams) for the process connections are to be found in the following documents:

- Technical Information Promass 80/83 F, M (TI 053D/06/en)
- Technical Information Promass 80/83 E (TI 061D/06/en)
- Technical Information Promass 80/83 A (TI 054D/06/en)
- Technical Information Promass 80/83 H, I (TI 052D/06/en)

Pressure ranges of secondary containment:
- Promass F: DN 8...50: 40 bar or 600 psi; DN 80: 25 bar or 375 psi; DN 100...150: 16 bar or 250 psi
- Promass M: 100 bar or 1500 psi
- Promass E: No secondary containment
- Promass A: 25 bar or 375 psi
- Promass H: DN 8...15: 25 bar or 375 psi; DN 25...50: 16 bar or 250 psi
- Promass I: 40 bar or 600 psi

Limiting flow

See Page 111 ff. (“Measuring range”)

Select nominal diameter by optimising between required flow range and permissible pressure loss. See Page 111 for a list of max. possible full scale values.
- The minimum recommended full scale value is approx. $^1/_{20}$ of the max. full scale value.
- In most applications, 20...50% of the maximum full scale value can be considered ideal.
- Select a lower full scale value for abrasive substances such as fluids with entrained solids (flow velocity < 1 m/s).
- For gas measurement the following rules apply:
  – Flow velocity in the measuring tubes should not be more than half the sonic velocity (0.5 Mach).
  – The maximum mass flow depends on the density of the gas (see formula on Page 112)

Pressure loss

Pressure loss depends on the properties of the fluid and on its flow. The following formulas can be used to approximately calculate the pressure loss:

Pressure loss formulas for Promass F, M and E

Reynolds number	$Re = \frac{2 \cdot \dot{m}}{\pi \cdot d \cdot \upsilon \cdot \rho}$
$Re \geq 2300$ [1]	$\Delta p = K \cdot \upsilon^{0.25} \cdot \dot{m}^{1.85} \cdot \rho^{-0.86}$
$Re < 2300$	$\Delta p = K1 \cdot \upsilon \cdot \dot{m} + \frac{K2 \cdot \upsilon^{0.25} \cdot \dot{m}^2}{\rho}$
Δp = pressure loss [mbar] υ = kinematic viscosity [m^2/s] $\dot{m}$ = mass flow [kg/s]	ρ = fluid density [kg/m^3] d = inside diameter of measuring tubes [m] K...K2 = constants (depending on nominal diameter)
[1] To compute the pressure loss for gases, always use the formula for $Re \geq 2300$.	

Pressure loss formulas for Promass A, H and I

Reynolds number	$Re = \frac{4 \cdot \dot{m}}{\pi \cdot d \cdot \upsilon \cdot \rho}$
$Re \geq 2300$ [1]	$\Delta p = K \cdot \upsilon^{0.25} \cdot \dot{m}^{1.75} \cdot \rho^{-0.75} + \frac{K3 \cdot \dot{m}^2}{\rho}$
$Re < 2300$	$\Delta p = K1 \cdot \upsilon \cdot \dot{m} + \frac{K3 \cdot \dot{m}^2}{\rho}$
Δp = pressure loss [mbar] υ = kinematic viscosity [m^2/s] $\dot{m}$ = mass flow [kg/s]	ρ = fluid density [kg/m^3] d = inside diameter of measuring tubes [m] K...K3 = constants (depending on nominal diameter)
[1] To compute the pressure loss for gases, always use the formula for $Re \geq 2300$.	

Pressure loss coefficient for Promass F

DN	d [m]	K	K1	K2
8	$5.35 \cdot 10^{-3}$	$5.70 \cdot 10^{7}$	$9.60 \cdot 10^{7}$	$1.90 \cdot 10^{7}$
15	$8.30 \cdot 10^{-3}$	$5.80 \cdot 10^{6}$	$1.90 \cdot 10^{7}$	$10.60 \cdot 10^{5}$
25	$12.00 \cdot 10^{-3}$	$1.90 \cdot 10^{6}$	$6.40 \cdot 10^{6}$	$4.50 \cdot 10^{5}$
40	$17.60 \cdot 10^{-3}$	$3.50 \cdot 10^{5}$	$1.30 \cdot 10^{6}$	$1.30 \cdot 10^{5}$
50	$26.00 \cdot 10^{-3}$	$7.00 \cdot 10^{4}$	$5.00 \cdot 10^{5}$	$1.40 \cdot 10^{4}$
80	$40.50 \cdot 10^{-3}$	$1.10 \cdot 10^{4}$	$7.71 \cdot 10^{4}$	$1.42 \cdot 10^{4}$
100	$51.20 \cdot 10^{-3}$	$3.54 \cdot 10^{3}$	$3.54 \cdot 10^{4}$	$5.40 \cdot 10^{3}$
150	$68.90 \cdot 10^{-3}$	$1.36 \cdot 10^{3}$	$2.04 \cdot 10^{4}$	$6.46 \cdot 10^{2}$

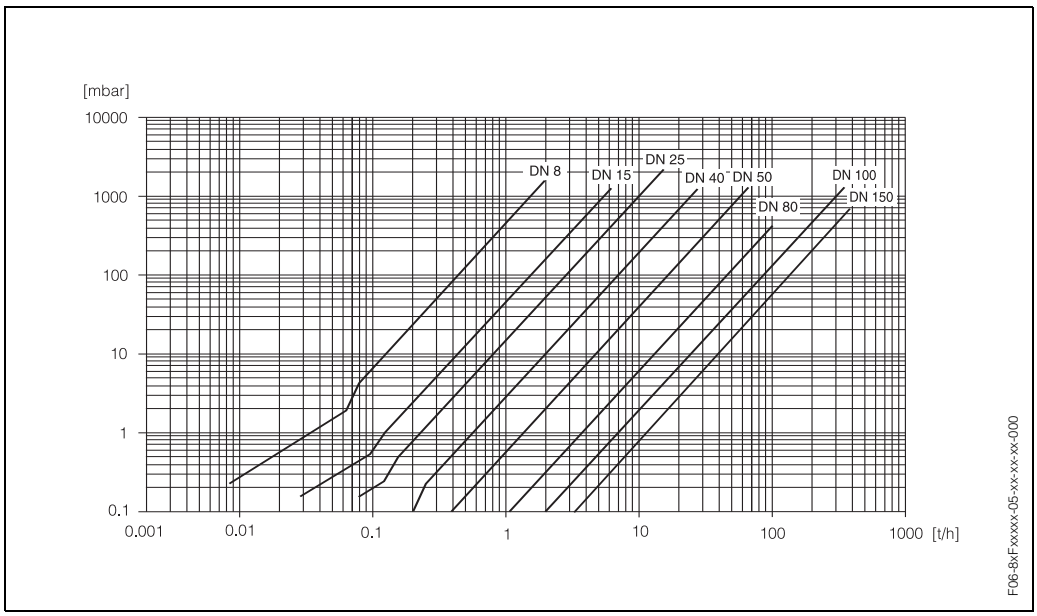


Fig. 44: Pressure loss diagram for water

Pressure loss coefficient for Promass M

DN	d [m]	K	K1	K2
8	$5.53 \cdot 10^{-3}$	$5.2 \cdot 10^{7}$	$8.6 \cdot 10^{7}$	$1.7 \cdot 10^{7}$
15	$8.55 \cdot 10^{-3}$	$5.3 \cdot 10^{6}$	$1.7 \cdot 10^{7}$	$9.7 \cdot 10^{5}$
25	$11.38 \cdot 10^{-3}$	$1.7 \cdot 10^{6}$	$5.8 \cdot 10^{6}$	$4.1 \cdot 10^{5}$
40	$17.07 \cdot 10^{-3}$	$3.2 \cdot 10^{5}$	$1.2 \cdot 10^{6}$	$1.2 \cdot 10^{5}$
50	$25.60 \cdot 10^{-3}$	$6.4 \cdot 10^{4}$	$4.5 \cdot 10^{5}$	$1.3 \cdot 10^{4}$
80	$38.46 \cdot 10^{-3}$	$1.4 \cdot 10^{4}$	$8.2 \cdot 10^{4}$	$3.7 \cdot 10^{3}$
High pressure version				
8	$4.93 \cdot 10^{-3}$	$6.0 \cdot 10^{7}$	$1.4 \cdot 10^{8}$	$2.8 \cdot 10^{7}$
15	$7.75 \cdot 10^{-3}$	$8.0 \cdot 10^{6}$	$2.5 \cdot 10^{7}$	$1.4 \cdot 10^{6}$
25	$10.20 \cdot 10^{-3}$	$2.7 \cdot 10^{6}$	$8.9 \cdot 10^{6}$	$6.3 \cdot 10^{5}$

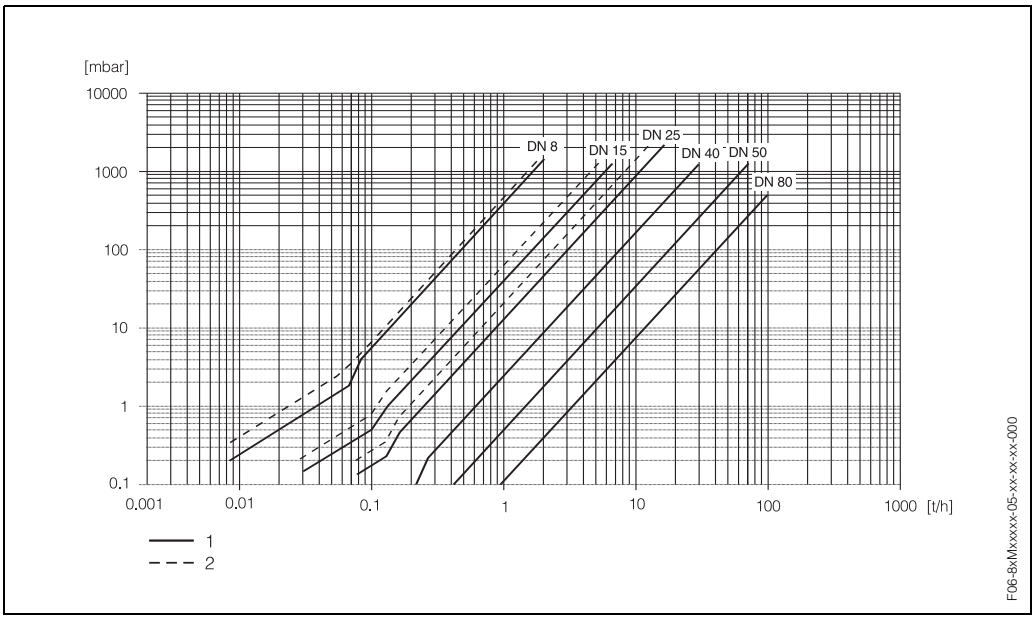


Fig. 45: Pressure loss diagram for water

1 Promass M
2 Promass M (high pressure version)

Pressure loss coefficient for Promass E

DN	d [m]	K	K1	K2
8	$5.35 \cdot 10^{-3}$	$5.70 \cdot 10^{7}$	$7.91 \cdot 10^{7}$	$2.10 \cdot 10^{7}$
15	$8.30 \cdot 10^{-3}$	$7.62 \cdot 10^{6}$	$1.73 \cdot 10^{7}$	$2.13 \cdot 10^{6}$
25	$12.00 \cdot 10^{-3}$	$1.89 \cdot 10^{6}$	$4.66 \cdot 10^{6}$	$6.11 \cdot 10^{5}$
40	$17.60 \cdot 10^{-3}$	$4.42 \cdot 10^{5}$	$1.35 \cdot 10^{6}$	$1.38 \cdot 10^{5}$
50	$26.00 \cdot 10^{-3}$	$8.54 \cdot 10^{4}$	$4.02 \cdot 10^{5}$	$2.31 \cdot 10^{4}$

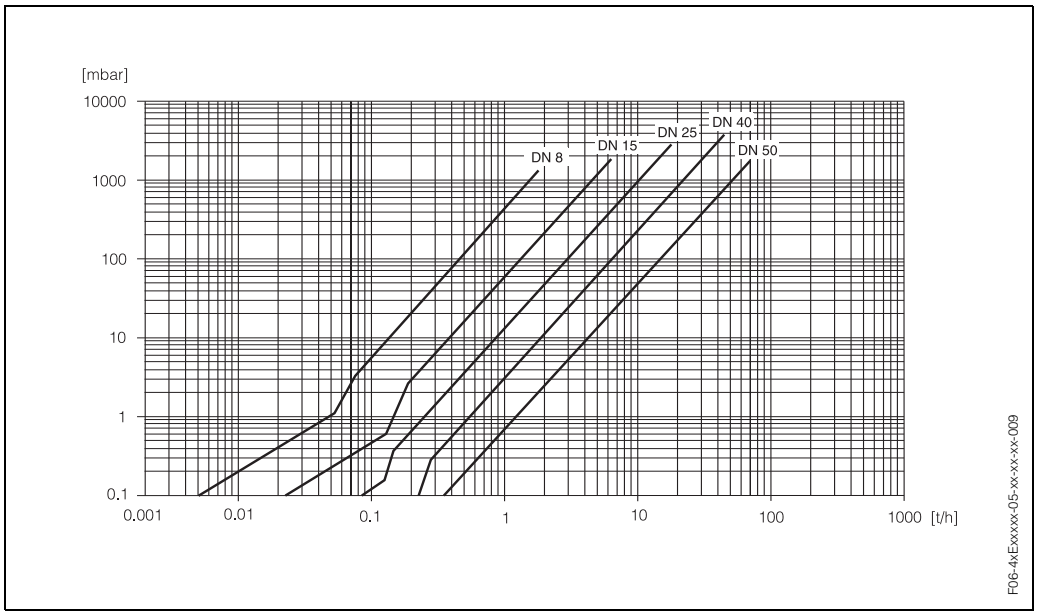


Fig. 46: Pressure loss diagram for water

Pressure loss coefficient for Promass A

DN	d [m]	K	K1	K3
1	$1.10 \cdot 10^{-3}$	$1.2 \cdot 10^{11}$	$1.3 \cdot 10^{11}$	0
2	$1.80 \cdot 10^{-3}$	$1.6 \cdot 10^{10}$	$2.4 \cdot 10^{10}$	0
4	$3.50 \cdot 10^{-3}$	$9.4 \cdot 10^{8}$	$2.3 \cdot 10^{9}$	0
High pressure version				
2	$1.40 \cdot 10^{-3}$	$5.4 \cdot 10^{10}$	$6.6 \cdot 10^{10}$	0
4	$3.00 \cdot 10^{-3}$	$2.0 \cdot 10^{9}$	$4.3 \cdot 10^{9}$	0

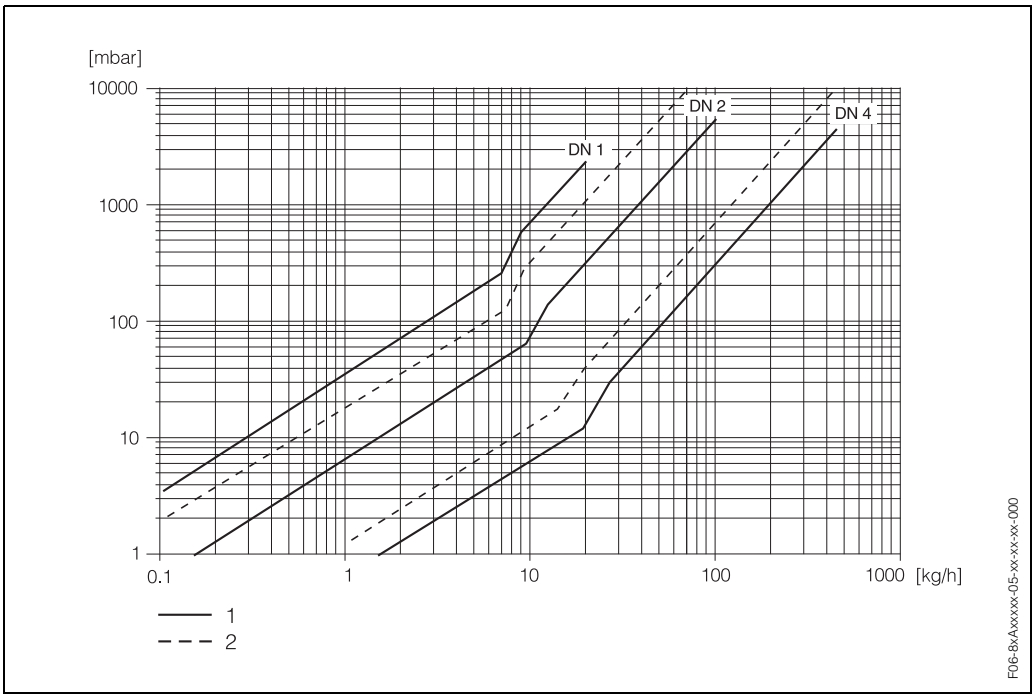


Fig. 47: Pressure loss diagram for water

1 Standard version
2 High pressure version

Pressure loss coefficient for Promass H

DN	d [m]	K	K1	K3
8	$8.51 \cdot 10^{-3}$	$8.04 \cdot 10^{6}$	$3.28 \cdot 10^{7}$	$1.15 \cdot 10^{6}$
15	$12.00 \cdot 10^{-3}$	$1.81 \cdot 10^{6}$	$9.99 \cdot 10^{6}$	$1.87 \cdot 10^{5}$
25	$17.60 \cdot 10^{-3}$	$3.67 \cdot 10^{5}$	$2.76 \cdot 10^{6}$	$4.99 \cdot 10^{4}$
40	$25.50 \cdot 10^{-3}$	$8.75 \cdot 10^{4}$	$8.67 \cdot 10^{5}$	$1.22 \cdot 10^{4}$
50	$40.5 \cdot 10^{-3}$	$1.35 \cdot 10^{4}$	$1.72 \cdot 10^{5}$	$1.20 \cdot 10^{3}$
Pressure loss data includes interface between measuring tube and piping				

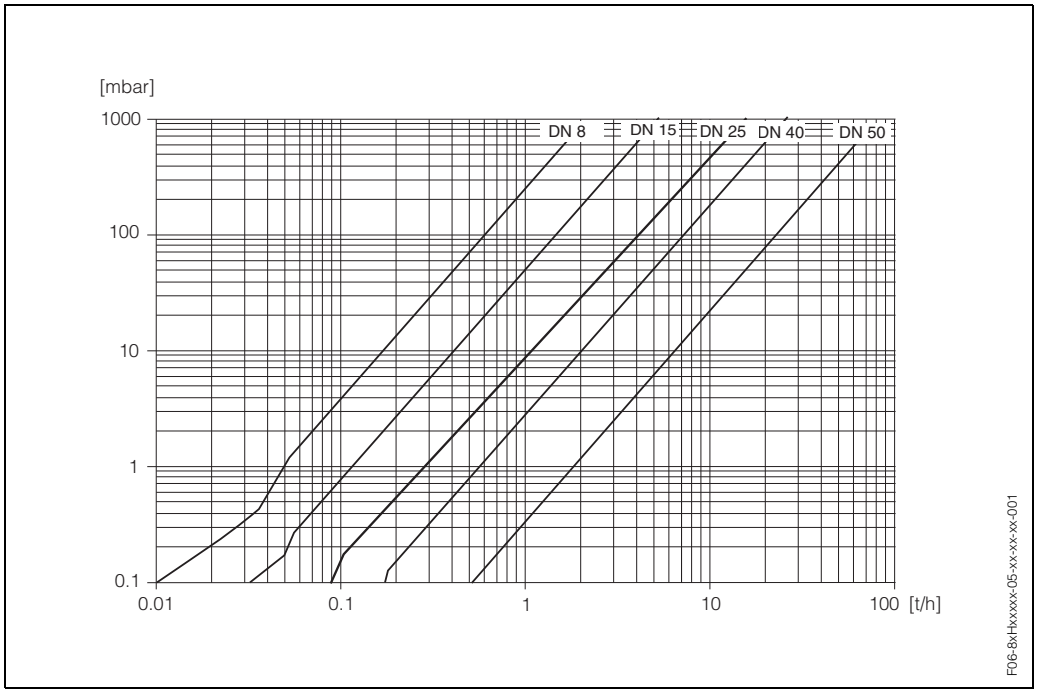


Fig. 48: Pressure loss diagram for water

Pressure loss coefficient for Promass I

DN	d [m]	K	K1	K3
8	$8.55 \cdot 10^{-3}$	$8.1 \cdot 10^{6}$	$3.9 \cdot 10^{7}$	$129.95 \cdot 10^{4}$
15	$11.38 \cdot 10^{-3}$	$2.3 \cdot 10^{6}$	$1.3 \cdot 10^{7}$	$23.33 \cdot 10^{4}$
15 [1)]	$17.07 \cdot 10^{-3}$	$4.1 \cdot 10^{5}$	$3.3 \cdot 10^{6}$	$0.01 \cdot 10^{4}$
25	$17.07 \cdot 10^{-3}$	$4.1 \cdot 10^{5}$	$3.3 \cdot 10^{6}$	$5.89 \cdot 10^{4}$
25 [1)]	$25.60 \cdot 10^{-3}$	$7.8 \cdot 10^{4}$	$8.5 \cdot 10^{5}$	$0.11 \cdot 10^{4}$
40	$25.60 \cdot 10^{-3}$	$7.8 \cdot 10^{4}$	$8.5 \cdot 10^{5}$	$1.19 \cdot 10^{4}$
40 [1)]	$35.62 \cdot 10^{-3}$	$1.3 \cdot 10^{4}$	$2.0 \cdot 10^{5}$	$0.08 \cdot 10^{4}$
50	$35.62 \cdot 10^{-3}$	$1.3 \cdot 10^{4}$	$2.0 \cdot 10^{5}$	$0.25 \cdot 10^{4}$

Pressure loss data includes interface between measuring tube and piping
[1)] DN 15, 25, 40 “FB” = Full bore versions of Promass I

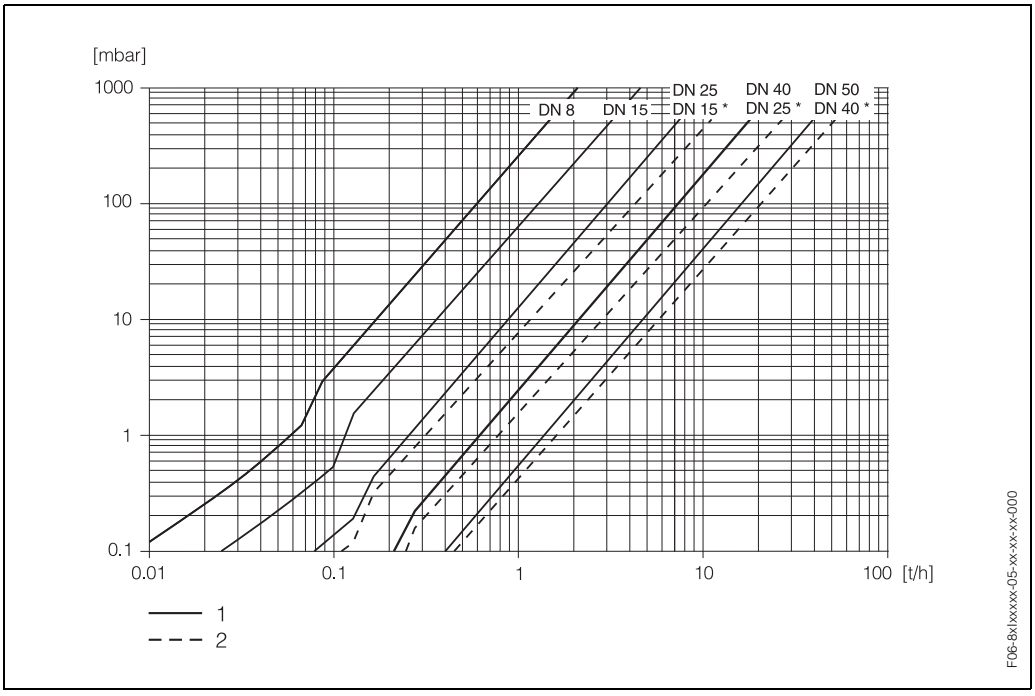


Fig. 49: Pressure loss diagram for water

1 Standard versions
2 Full bore versions (*)

10.1.8 Mechanical construction

Design / dimensions

see Page 133 ff.

Weight

- Compact version: see table below
- Remote version:
  – Sensor: see table below
  – Wall-mount housing: 5 kg

Promass F / DN	8	15	25	40	50	80	100	150
Compact version in [kg]	11.0	12.0	14.0	19.0	30.0	55.0	96.0	154.0
High-temperature compact version in [kg]	–	–	14.7	–	30.7	55.7	–	–
Remote version in [kg]	9.0	10.0	12.0	17.0	28.0	53.0	94.0	152.0
High-temperature remote version in [kg]	–	–	13.5	–	29.5	54.5	–	–

Promass M / DN	8	15	25	40	50	80
Compact version in [kg]	11.0	12.0	15.0	24.0	41.0	67.0
Remote version in [kg]	9.0	10.0	13.0	22.0	39.0	65.0

Promass E / DN	8	15	25	40	50
Compact version in [kg]	8.0	8.0	10.0	15.0	22.0
Remote version in [kg]	6.0	6.0	8.0	13.0	20.0

Promass A / DN	1	2	4
Compact version in [kg]	10.0	11.0	15.0
Remote version in [kg]	8.0	9.0	13.0

Promass H / DN	8	15	25	40	50
Compact version in [kg]	12.0	13.0	19.0	36.0	69.0
Remote version in [kg]	10.0	11.0	17.0	34.0	67.0

Promass I / DN	8	15	15 1)	25	25 1)	40	40 1)	50
Compact version in [kg]	12.0	15.0	20.0	20.0	41.0	41.0	67.0	67.0
Remote version in [kg]	10.0	13.0	18.0	18.0	39.0	39.0	65.0	65.0
1) DN 15, 25, 40 “FB” = Full bore versions of Promass I								

– All values (weight) refer to devices with EN/DIN PN 40 flanges.

Materials

Transmitter housing:
- Compact housing: stainless steel 1.4301/304
- Compact housing: powder coated die-cast aluminium
- Wall-mount housing: powder coated die-cast aluminium
- Remote field housing: powder-coated die-cast aluminium

Sensor housing / containment:
- Promass F: acid- and alkali-resistant outer surface
  DN 8...50: stainless steel 1.4301/304
  DN 80...150: stainless steel 1.4301/304 and 1.4308/304L
- Promass M: acid- and alkali-resistant outer surface
  – DN 8...50: steel, chemically nickel-plated
  – DN 80: stainless steel
- Promass E, A, H, I: acid- and alkali-resistant outer surface; stainless steel 1.4301/304

Connection housing, sensor (remote version):
- Stainless steel 1.4301/304 (standard version)
- powder coated die-cast aluminium (high-temperature version and version for heating)

Process connections, Promass F:
- Flanges EN 1092-1 (DIN 2501) / ANSI B16.5 / JIS B2238 → stainless steel 1.4404/316L
- Flanges EN 1092-1 (DIN 2501) / ANSI B16.5 / JIS B2238 → Alloy C-22 2.4602/N 06022
- Flange DIN 11864-2 Form A (flat flange) → stainless steel 1.4404/316L
- Hygienic coupling DIN 11851 / SMS 1145 → stainless steel 1.4404/316L
- Couplings ISO 2853 / DIN 11864-1 → stainless steel 1.4404/316L
- Tri-Clamp → stainless steel 1.4404/316L

Process connections, Promass F: (high-temperature version):
- Flanges EN 1092-1 (DIN 2501) / ANSI B16.5 / JIS B2238 → stainless steel 1.4404/316L
- Flanges EN 1092-1 (DIN 2501) / ANSI B16.5 / JIS B2238 → Alloy C-22 2.4602 (N 06022)

Process connections, Promass M:
- Flanges EN 1092-1 (DIN 2501) / ANSI B16.5 / JIS B2238 → stainless steel 1.4404/316L, titanium grade 2
- Flange DIN 11864-2 Form A (flat flange) → stainless steel 1.4404/316L
- PVDF connection to DIN / ANSI / JIS
- Hygienic coupling DIN 11851 / SMS 1145 → stainless steel 1.4404/316L
- Couplings ISO 2853 / DIN 11864-1 → stainless steel 1.4404/316L
- Tri-Clamp → stainless steel 1.4404/316L

Process connections, Promass M (high pressure version):
- Connector → stainless steel 1.4404/316L
- Couplings → stainless steel 1.4401/316

Process connections, Promass E:
- Flanges EN 1092-1 (DIN 2501) / ANSI B16.5 / JIS B2238 → Stainless steel 1.4404/316L
- Flange DIN 11864-2 Form A (flat flange) → Stainless steel 1.4404/316L
- VCO connection → Stainless steel 1.4404/316L
- Hygienic coupling DIN 11851 / SMS 1145 → Stainless steel 1.4404/316L
- Couplings ISO 2853 / DIN 11864-1 → Stainless steel 1.4404/316L
- Tri-Clamp → Stainless steel 1.4404/316L

Process connections, Promass A:
- Mounting set for flanges EN 1092-1 (DIN 2501) / ANSI B16.5 / JIS B2238 → stainless steel 1.4539/904L, Alloy C-22 2.4602/N 06022. Loose flanges → stainless steel 1.4404/316L
- VCO coupling → stainless steel 1.4539/904L, Alloy C-22 2.4602/N 06022
- Tri-Clamp (1/2") → stainless steel 1.4539/904L
- Mounting set for SWAGELOK (1/4", 1/8") → stainless steel 1.4401/316
- Mounting set for NPT-F (1/4") → stainless steel 1.4539/904L, Alloy C-22 2.4602/N 06022

Process connections, Promass H:
- Flanges EN 1092-1 (DIN 2501) / ANSI B16.5 / JIS B2238 → stainless steel 1.4301/304, parts in contact with medium: zirconium 702

Process connections, Promass I:
- Flanges EN 1092-1 (DIN 2501) / ANSI B16.5 / JIS B2238 → stainless steel 1.4301/304, parts in contact with medium: titanium grade 9
- Flange DIN 11864-2 Form A (flat flange) → titanium grade 2
- Hygienic coupling DIN 11851 / SMS 1145 → titanium grade 2
- Couplings ISO 2853 / DIN 11864-1 → titanium grade 2
- Tri-Clamp → titanium grade 2

Measuring tube(s):
- Promass F:
  – DN 8...100: stainless steel 1.4539 (904L)
  – DN 150: stainless steel 1.4404/316L
  – DN 8...80: Alloy C-22 2.4602/N 06022
- Promass F (high-temperature version):
  – DN 25, 50, 80: Alloy C-22 2.4602/N 06022
- Promass M:
  – DN 8...50: titanium grade 9
  – DN 80: titanium grade 2
- Promass M (high pressure version): titanium grade 9
- Promass E: stainless steel 1.4539/904L
- Promass A: stainless steel 1.4539/904L, Alloy C-22 2.4602/N 06022
- Promass H: zirconium 702/R 60702
- Promass I: titanium grade 9

Seals:
- Promass F, E, H, I: welded process connections without internal seals
- Promass M: Viton, EPDM, silicon, Kalrez, FEP-jacketed (not for gas applications)
- Promass A: Viton, EPDM, silicon, Kalrez

Material load diagram

The material load curves (pressure-temperature diagrams) for the process connections are to be found in the following documents:

- Technical Information Promass 80/83 F, M (TI 053D/06/en)
- Technical Information Promass 80/83 E (TI 061D/06/en)
- Technical Information Promass 80/83 A (TI 054D/06/en)
- Technical Information Promass 80/83 H, I (TI 052D/06/en)

Process connections

see Page 129

10.1.9 Human interface

Display elements

- Liquid crystal display: illuminated, four lines with 16 characters per line
- Selectable display of different measured values and status variables
- 3 totalizers
- At ambient temperatures below –20 °C the readability of the display may be impaired.

Operating elements

- Local operation with three optical sensors (–, +, E)
- Application specific Quick Setup menus for straightforward commissioning

Language group	Language groups for operation in different countries: • Western Europe and America: English, German, Spanish, Italian, French, Dutch and Portuguese • Northern/eastern Europe: English, Russian, Polish, Norwegian, Finnish, Swedish and Czech • Southern/eastern Asia: English, Japanese and Indonesian
Remote operation	Operation by means of HART protocol

10.1.10 Certificates and approvals

Ex approvals	Information about currently available Ex versions (ATEX, FM, CSA) can be supplied by your E+H Sales Centre on request. All explosion protection data are given in a separate documentation which is available upon request.
Sanitary compatibility	• 3A authorization (all measuring systems, except Promass H) • EHEDG-tested (Promass A and Promass I only)
Pressure device approval	Flow meters with a nominal diameter smaller or equal DN 25 are covered by Art. 3(3) of the European directive 97/23/EG (Pressure Equipment Directive) and are designed according to sound engineer practice. For larger nominal diameter, optional approvals according to Cat. III are available when required (depends on fluid and process pressure).
Functional safety	SIL 2: accordance IEC 61508/IEC 61511-1 (FDIS)
CE mark	The measuring system is in conformity with the statutory requirements of the EC Directives. Endress+Hauser confirms successful testing of the device by affixing to it the CE mark.
Other standards and guidelines	EN 60529: Degrees of protection by housing (IP code) EN 61010: Protection Measures for Electrical Equipment for Measurement, Control, Regulation and Laboratory Procedures. EN 61326/A1 (IEC 1326): Electromagnetic compatibility (EMC requirements) NAMUR NE 21: Electromagnetic compatibility (EMC) of imdustrial process and laboratory control equipment. MAMUR NE 43: Standardisation of the signal level for the breakdown information of digital transmitters with analogue output signal.

10.1.11 Ordering information

The E+H service organisation can provide detailed ordering information and information on the order codes on request.

10.1.12 Accessories

Various accessories, which can be ordered separately from Endress+Hauser, are available for the transmitter and the sensor (Page 87). The E+H service organisation can provide detailed information on the order codes of your choice.

10.1.13 Documentation

- ❑ System Information Promass (SI 032D/06/en)
- ❑ Technical Information Promass 80/83 F, M (TI 053D/06/en)
- ❑ Technical Information Promass 80/83 E (TI 061D/06/en)
- ❑ Technical Information Promass 80/83 A (TI 054D/06/en)
- ❑ Technical Information Promass 80/83 H, I (TI 052D/06/en)
- ❑ Description of Device Functions Promass 83 (BA 060D/06/en)
- ❑ Supplementary documentation on Ex-ratings: ATEX, FM, CSA
- ❑ Functional safety manual Promass 80/83 (SD077D/06/en)

10.2 Dimensions: Wall-mount housing

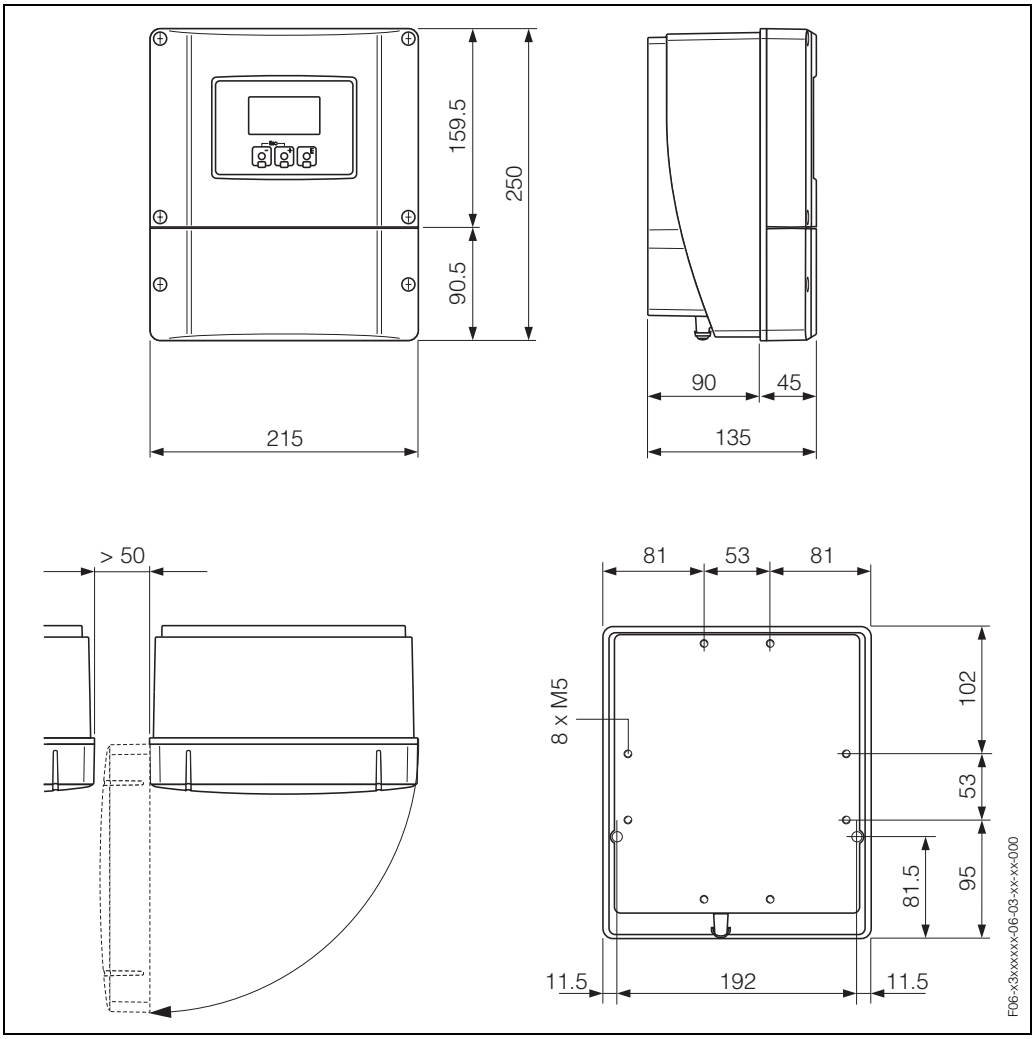


Fig. 50: Dimensions of wall-mount housing

10.3 Dimensions: Stainless steel field housing

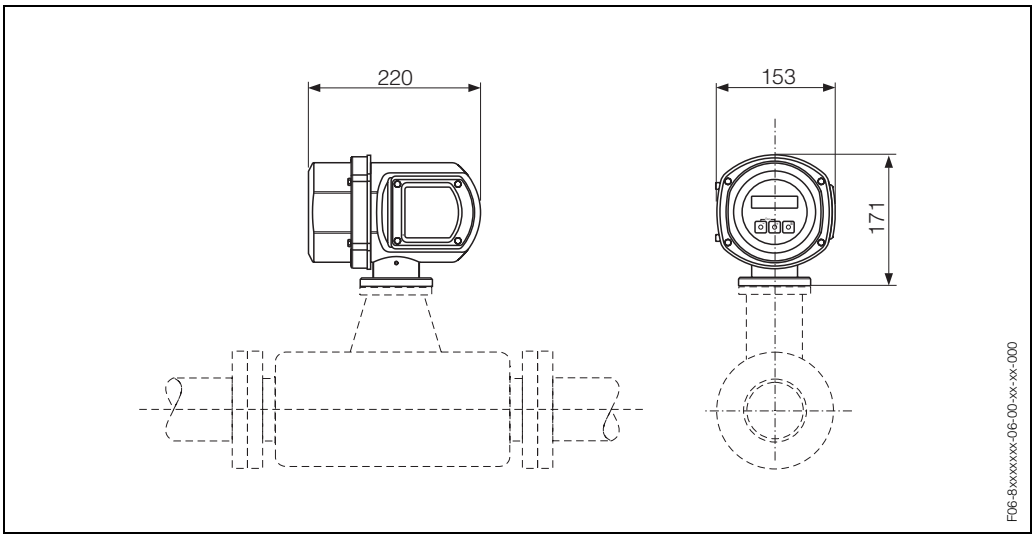


Fig. 51: Dimensions: stainless steel field housing

10.4 Dimensions: Remote version (Promass F, M, A, H, I)

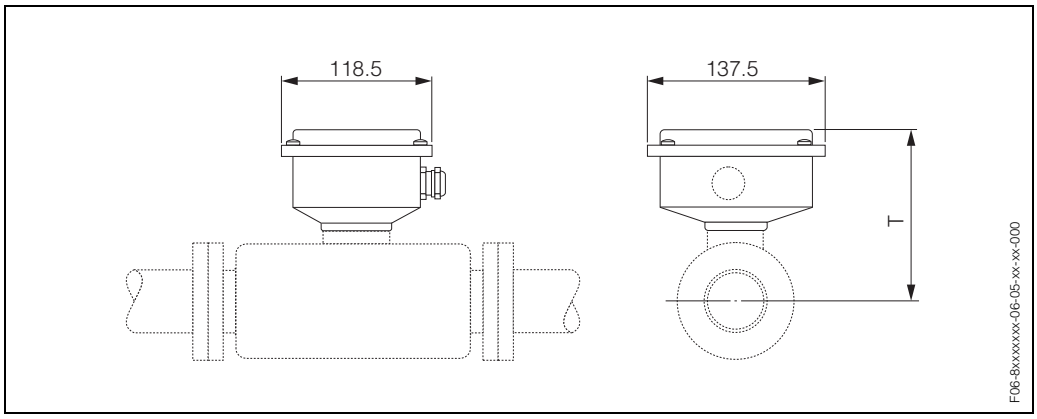


Fig. 52: Dimensions of sensor connection housing (remote version), T = dimension B in compact version with corresponding nominal diameter minus 153 mm

10.5 Dimensions: Remote version (Promass E)

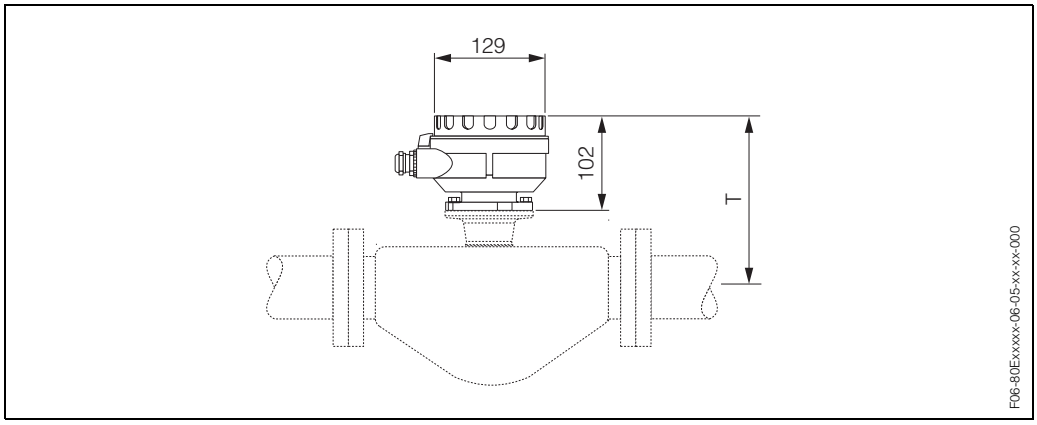


Fig. 53: Dimensions of sensor connection housing of Promass E (remote version), T = dimension B in compact version with corresponding nominal diameter minus 58 mm

10.6 Dimensions: Remote version for heating

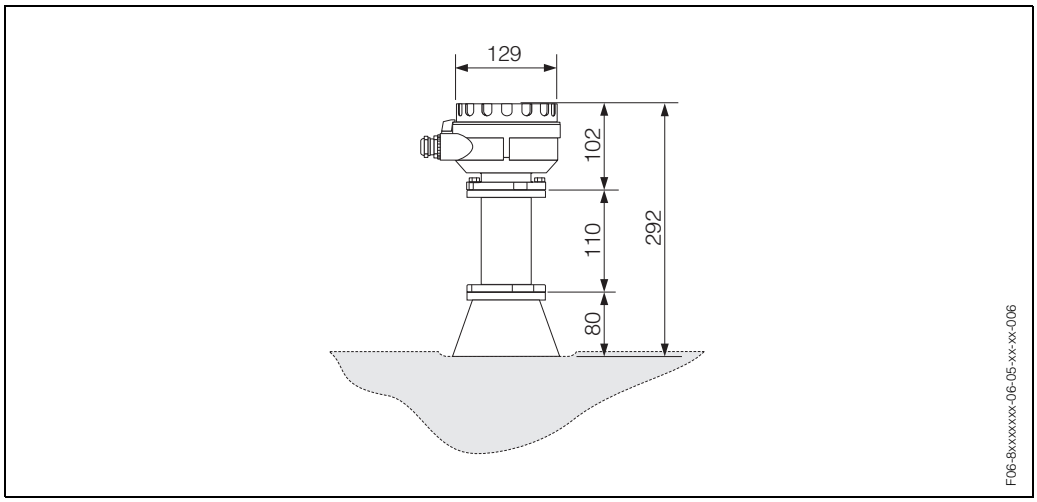


Fig. 54: Dimensions of sensor connection housing, remote version for heating ("long-necked" version)

10.7 Dimensions: High-temperature version (compact)

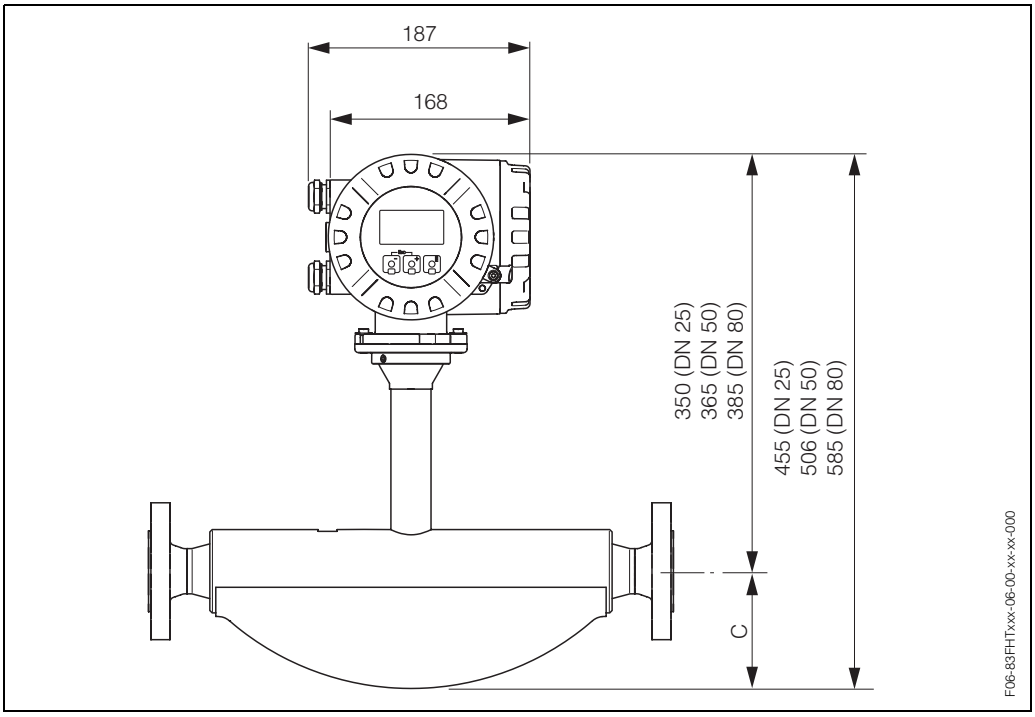


Fig. 55: The dimension C corresponds to the dimension of the standard version for nominal diameters DN 50 and DN 80. Exception is DN 25: here the dimension C corresponds to the dimension of nominal diameter DN 40.

10.8 Dimensions: High-temperature version (remote)

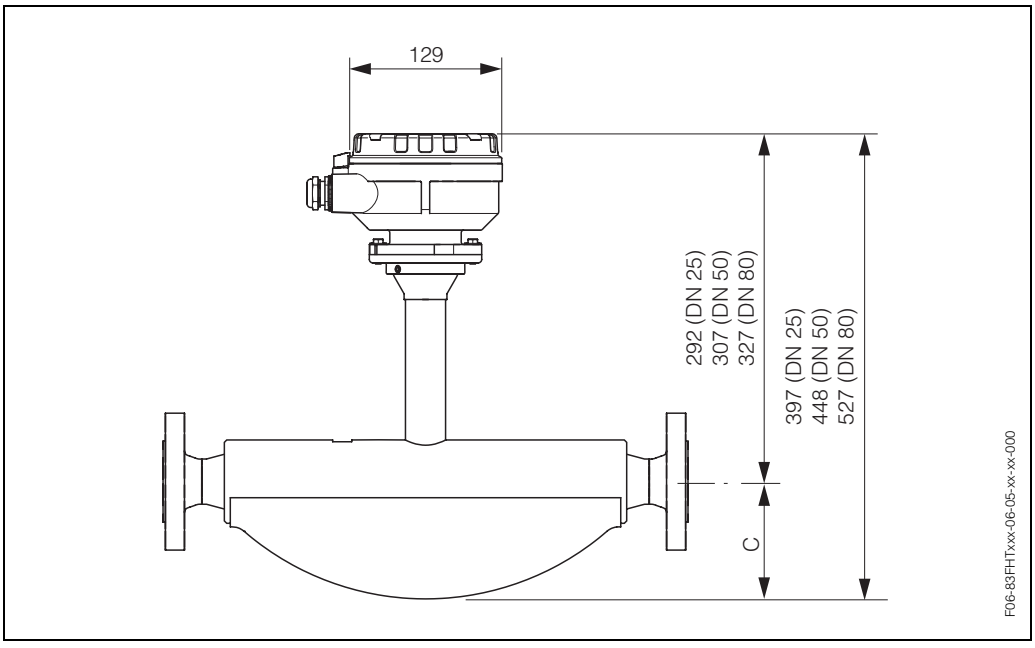


Fig. 56: The dimension C corresponds to the dimension of the standard version for nominal diameters DN 50 and DN 80. Exception is DN 25: here the dimension C corresponds to the dimension of nominal diameter DN 40.

10.9 Dimensions: Promass F

Dimensions Promass F: flange connections EN (DIN), ANSI, JIS

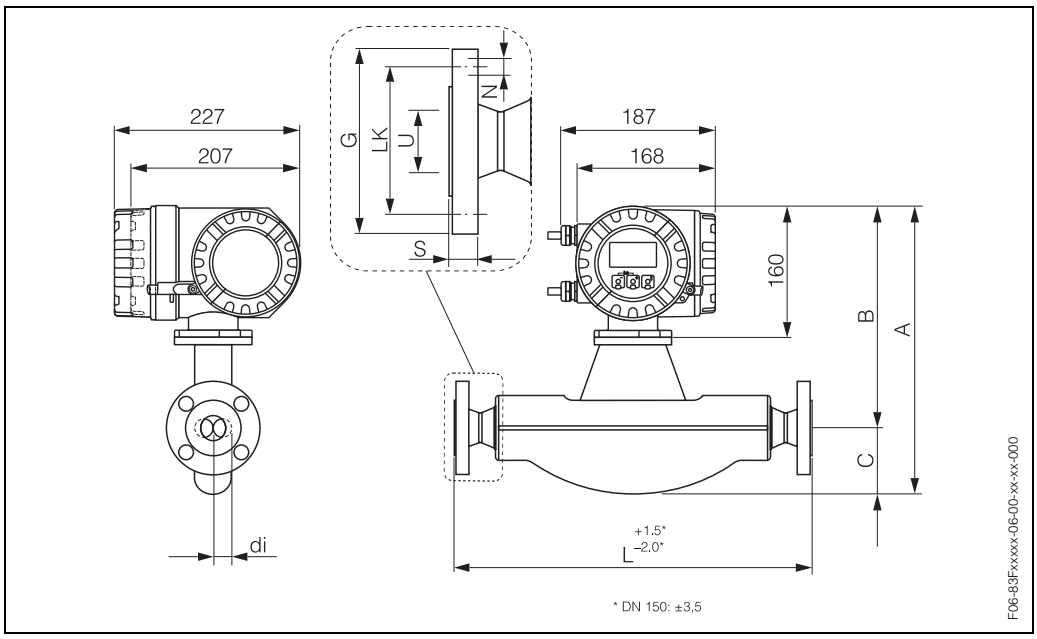


Fig. 57: Dimensions Promass F: flange connections EN (DIN), ANSI, JIS

Flange EN 1092-1 (DIN 2501 / DIN 2512N [1]) / PN 16: 1.4404/316L Surface roughness (flange): EN 1092-1 Form B1 (DIN 2526 Form C), Ra 6.3...12.5 µm										
DN	A	B	C	G	L	N	S	LK	U	di
100	571	324	247	220	1128	8 x Ø18	20	180	107.1	51.20
150	740	362	378	285	1330	8 x Ø22	22	240	159.3	68.90
[1] Flange with groove to EN 1092-1 Form D (DIN 2512N) available										

Flange EN 1092-1 (DIN 2501 / DIN 2512N [1]) / PN 40: 1.4404/316L, Alloy C-22 Surface roughness (flange): EN 1092-1 Form B1 (DIN 2526 Form C), Ra 6.3...12.5 µm										
DN	A	B	C	G	L	N	S	LK	U	di
8	341	266	75	95	370	4 x Ø14	16	65	17.3	5.35
15	341	266	75	95	404	4 x Ø14	16	65	17.3	8.30
25	341	266	75	115	440	4 x Ø14	18	85	28.5	12.00
40	376	271	105	150	550	4 x Ø18	18	110	43.1	17.60
50	424	283	141	165	715	4 x Ø18	20	125	54.5	26.00
80	505	305	200	200	840	8 x Ø18	24	160	82.5	40.50
100 [2]	571	324	247	235	1128	8 x Ø22	24	190	107.1	51.20
150 [2]	740	362	378	300	1370	8 x Ø26	28	250	159.3	68.90
[1] Flange with groove to EN 1092-1 Form D (DIN 2512N) available [2] Not available in Alloy C-22										

Flange EN 1092-1 (DIN 2501) / PN 40 (with DN 25 flanges): 1.4404/316L Surface roughness (flange): EN 1092-1 Form B1 (DIN 2526 Form C), Ra 6.3...12.5 µm										
DN	A	B	C	G	L	N	S	LK	U	di
8	341	266	75	115	440	4 x Ø14	18	85	28.5	5.35
15	341	266	75	115	440	4 x Ø14	18	85	28.5	8.30

Flange EN 1092-1 (DIN 2501 / DIN 2512N [1]) / PN 63: 1.4404/316L, Alloy C-22
Surface roughness (flange): EN 1092-1 Form B2 (DIN 2526 Form E), Ra 1.6...3.2 µm

DN	A	B	C	G	L	N	S	LK	U	di
50	424	283	141	180	724	4 x Ø22	26	135	54.5	26.00
80	505	305	200	215	875	8 x Ø22	28	170	81.7	40.50
100 [2]	571	324	247	250	1128	8 x Ø26	30	200	106.3	51.20
150 [2]	740	362	378	345	1410	8 x Ø33	36	280	157.1	68.90

[1] Flange with groove to EN 1092-1 Form D (DIN 2512N) available
[2] Not available in Alloy C-22

Flange EN 1092-1 (DIN 2501 / DIN 2512N [1]) / PN 100: 1.4404/316L, Alloy C-22
Surface roughness (flange): EN 1092-1 Form B2 (DIN 2526 Form E), Ra 1.6...3.2 µm

DN	A	B	C	G	L	N	S	LK	U	di
8	341	266	75	105	400	4 x Ø14	20	75	17.3	5.35
15	341	266	75	105	420	4 x Ø14	20	75	17.3	8.30
25	341	266	75	140	470	4 x Ø18	24	100	28.5	12.00
40	376	271	105	170	590	4 x Ø22	26	125	42.5	17.60
50	424	283	141	195	740	4 x Ø26	28	145	53.9	26.00
80	505	305	200	230	885	8 x Ø26	32	180	80.9	40.50
100 [2]	571	324	247	265	1128	8 x Ø30	36	210	104.3	51.20
150 [2]	740	362	378	355	1450	12 x Ø33	44	290	154.0	68.90

[1] Flange with groove to EN 1092-1 Form D (DIN 2512N) available
[2] Not available in Alloy C-22

Flange ANSI B16.5 / Cl 150: 1.4404/316L, Alloy C-22
Surface roughness (flange): Ra 3.2...6.3 µm

DN		A	B	C	G	L	N	S	LK	U	di
8	3/8"	341	266	75	88.9	370	4 x Ø15.7	11.2	60.5	15.7	5.35
15	1/2"	341	266	75	88.9	404	4 x Ø15.7	11.2	60.5	15.7	8.30
25	1"	341	266	75	108.0	440	4 x Ø15.7	14.2	79.2	26.7	12.00
40	1 1/2"	376	271	105	127.0	550	4 x Ø15.7	17.5	98.6	40.9	17.60
50	2"	424	283	141	152.4	715	4 x Ø19.1	19.1	120.7	52.6	26.00
80	3"	505	305	200	190.5	840	4 x Ø19.1	23.9	152.4	78.0	40.50
100 [1]	4"	571	324	247	228.6	1128	8 x Ø19.1	23.9	190.5	102.4	51.20
150 [1]	6"	6"	740	362	378	279.4	8 x Ø22.4	25.4	241.3	154.2	68.90

[1] Not available in Alloy C-22

Flange ANSI B16.5 / Cl 300: 1.4404/316L, Alloy C-22
Surface roughness (flange): Ra 3.2...6.3 µm

DN		A	B	C	G	L	N	S	LK	U	di
8	3/8"	341	266	75	95.2	370	4 x Ø15.7	14.2	66.5	15.7	5.35
15	1/2"	341	266	75	95.2	404	4 x Ø15.7	14.2	66.5	15.7	8.30
25	1"	341	266	75	123.9	440	4 x Ø19	17.5	88.9	26.7	12.00
40	1 1/2"	376	271	105	155.4	550	4 x Ø22.3	20.6	114.3	40.9	17.60
50	2"	424	283	141	165.1	715	8 x Ø19	22.3	127.0	52.6	26.00
80	3"	505	305	200	209.5	840	8 x Ø22.3	28.4	168.1	78.0	40.50
100 [1]	4"	571	324	247	254.0	1128	8 x Ø22.3	31.7	200.1	102.4	51.20
150 [1]	6"	740	362	378	317.5	1417	12xØ22.3	36.5	269.7	154.2	68.90

[1] Not available in Alloy C-22

Flange ANSI B16.5 / Cl 600: 1.4404/316L, Alloy C-22
Surface roughness (flange): Ra 3.2...6.3 µm

DN		A	B	C	G	L	N	S	LK	U	di
8	3/8"	341	266	75	95.3	400	4 x Ø15.7	20.6	66.5	13.9	5.35
15	1/2"	341	266	75	95.3	420	4 x Ø15.7	20.6	66.5	13.9	8.30
25	1"	341	266	75	124.0	490	4 x Ø19.1	23.9	88.9	24.3	12.00
40	1 1/2"	376	271	105	155.4	600	4 x Ø22.4	28.7	114.3	38.1	17.60
50	2"	424	283	141	165.1	742	8 x Ø19.1	31.8	127.0	49.2	26.00
80	3"	505	305	200	209.6	900	8 x Ø22.4	38.2	168.1	73.7	40.50
100 [1)]	4"	571	324	247	273.1	1158	8 x Ø25.4	48.4	215.9	97.3	51.20
150 [1)]	6"	740	362	378	355.6	1467	12xØ28.4	47.8	292.1	154.2	68.90

[1)] Not available in Alloy C-22

Flange JIS B2238 / 10K: 1.4404/316L, Alloy C-22
Surface roughness (flange): Ra 3.2...6.3 µm

DN	A	B	C	G	L	N	S	LK	U	di
50	424	283	141	155	715	4 x Ø19	16	120	50	26.00
80	505	305	200	185	832	8 x Ø19	18	150	80	40.50
100 [1)]	571	324	247	210	1128	8 x Ø19	18	175	100	51.20
150 [1)]	740	362	378	280	1354	8 x Ø23	22	240	150	68.90

[1)] Not available in Alloy C-22

Flange JIS B2238 / 20K: 1.4404/316L, Alloy C-22
Surface roughness (flange): Ra 3.2...6.3 µm

DN	A	B	C	G	L	N	S	LK	U	di
8	341	266	75	95	370	4 x Ø15	14	70	15	5.35
15	341	266	75	95	404	4 x Ø15	14	70	15	8.30
25	341	266	75	125	440	4 x Ø19	16	90	25	12.00
40	376	271	105	140	550	4 x Ø19	18	105	40	17.60
50	424	283	141	155	715	8 x Ø19	18	120	50	26.00
80	505	305	200	200	832	8 x Ø23	22	160	80	40.50
100 [1)]	571	324	241	225	1128	8 x Ø23	24	185	100	51.20
150 [1)]	740	362	378	305	1386	12 x Ø25	28	260	150	68.90

[1)] Not available in Alloy C-22

Flange JIS B2238 / 40K: 1.4404/316L, Alloy C-22
Surface roughness (flange): Ra 3.2...6.3 µm

DN	A	B	C	G	L	N	S	LK	U	di
8	341	266	75	115	400	4 x Ø19	20	80	15	5.35
15	341	266	75	115	425	4 x Ø19	20	80	15	8.30
25	341	266	75	130	485	4 x Ø19	22	95	25	12.00
40	376	271	105	160	600	4 x Ø23	24	120	38	17.60
50	424	283	141	165	760	8 x Ø19	26	130	50	26.00
80	505	305	200	210	890	8 x Ø23	32	170	75	40.50
100 [1)]	571	324	241	250	1168	8 x Ø25	36	205	100	51.20
150 [1)]	740	362	378	355	1498	12 x Ø33	44	295	150	68.90

[1)] Not available in Alloy C-22

Flange JIS B2238 / 63K: 1.4404/316L, Alloy C-22 Surface roughness (flange): Ra 3.2...6.3 µm										
DN	A	B	C	G	L	N	S	LK	U	di
8	341	266	75	120	420	4 x Ø19	23	85	12	5.35
15	341	266	75	120	440	4 x Ø19	23	85	12	8.30
25	341	266	75	140	494	4 x Ø23	27	100	22	12.00
40	376	271	105	175	620	4 x Ø25	32	130	35	17.60
50	424	283	141	185	775	8 x Ø23	34	145	48	26.00
80	505	305	200	230	915	8 x Ø25	40	185	73	40.50
100 [1]	571	324	247	270	1168	8 x Ø27	44	220	98	51.20
150 [1]	740	362	378	365	1528	12 x Ø33	54	305	146	68.90
[1] Not available in Alloy C-22										

Dimensions Promass F: Tri-Clamp connections

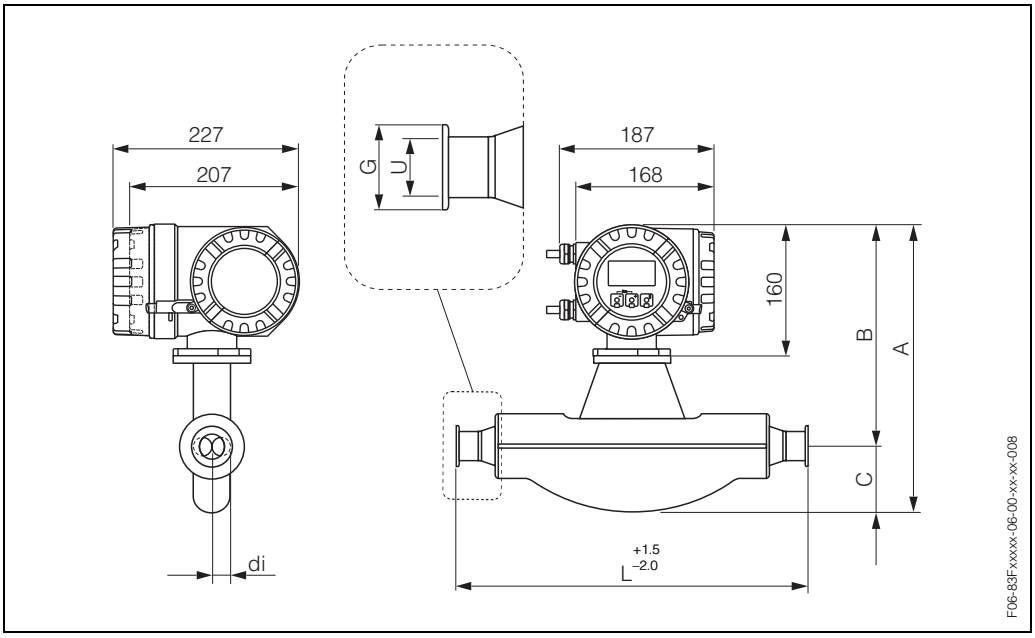


Fig. 58: Dimensions Promass F: Tri-Clamp connections

Tri-Clamp: 1.4404/316L								
DN	Clamp	A	B	C	G	L	U	di
8	1"	341	266	75	50.4	367	22.1	5.35
15	1"	341	266	75	50.4	398	22.1	8.30
25	1"	341	266	75	50.4	434	22.1	12.00
40	1 1/2"	376	271	105	50.4	560	34.8	17.60
50	2"	424	283	141	63.9	720	47.5	26.00
80	3"	505	305	200	90.9	900	72.9	40.50
100	4"	571	324	247	118.9	1128	97.4	51.20
3A version also available (Ra ≤ 0.8 µm/150 grit. Option: Ra ≤ 0.4 µm/240 grit)								

1/2" Tri-Clamp: 1.4404/316L								
DN	Clamp	A	B	C	G	L	U	di
8	1"	341	266	75	25.0	367	9.5	5.35
15	1"	341	266	75	25.0	398	9.5	8.30
3A version also available (Ra ≤ 0.8 µm/150 grit. Option: Ra ≤ 0.4 µm/240 grit)								

Dimensions Promass F: DIN 11851 connections (hygienic coupling)

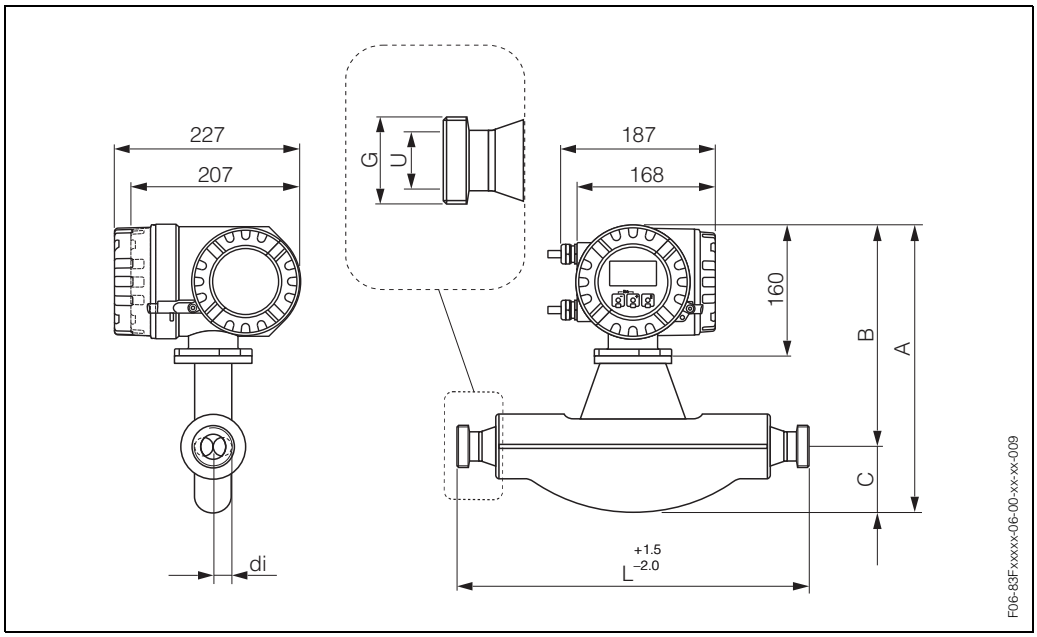


Fig. 59: Dimensions Promass F: DIN 11851 connections (hygienic coupling)

Hygienic coupling DIN 11851: 1.4404/316L							
DN	A	B	C	G	L	U	di
8	341	266	75	Rd 34 x 1/8"	367	16	5.35
15	341	266	75	Rd 34 x 1/8"	398	16	8.30
25	341	266	75	Rd 52 x 1/6"	434	26	12.00
40	376	271	105	Rd 65 x 1/6"	560	38	17.60
50	424	283	141	Rd 78 x 1/6"	720	50	26.00
80	505	305	200	Rd 110 x 1/4"	900	81	40.50
100	571	324	247	Rd 130 x 1/4"	1128	100	51.20
3A version also available (Ra ≤ 0.8 µm/150 grit)							

Dimensions Promass F: DIN 11864-1 Form A connections (couplings)

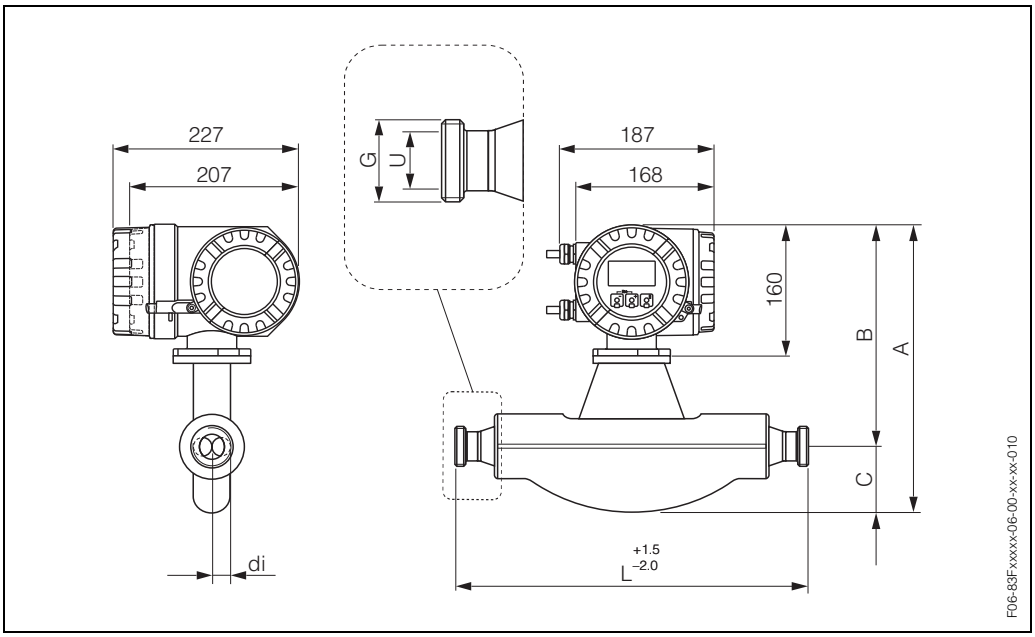


Fig. 60: Dimensions Promass F: DIN 11864-1 Form A connections (couplings)

Coupling DIN 11864-1 Form A: 1.4404/316L							
DN	A	B	C	G	L	U	di
8	341	266	75	Rd 28 x 1/8"	367	10	5.35
15	341	266	75	Rd 34 x 1/8"	398	16	8.30
25	341	266	75	Rd 52 x 1/6"	434	26	12.00
40	376	271	105	Rd 65 x 1/6"	560	38	17.60
50	424	283	141	Rd 78 x 1/6"	720	50	26.00
80	505	305	200	Rd 110 x 1/4"	900	81	40.50
100	571	324	247	Rd 130 x 1/4"	1128	100	51.20
3A version also available (Ra ≤ 0.8 µm/150 grit. Option: Ra ≤ 0.4 µm/240 grit)							

Dimensions Promass F: flange connections DIN 11864-2 Form A (flat flange)

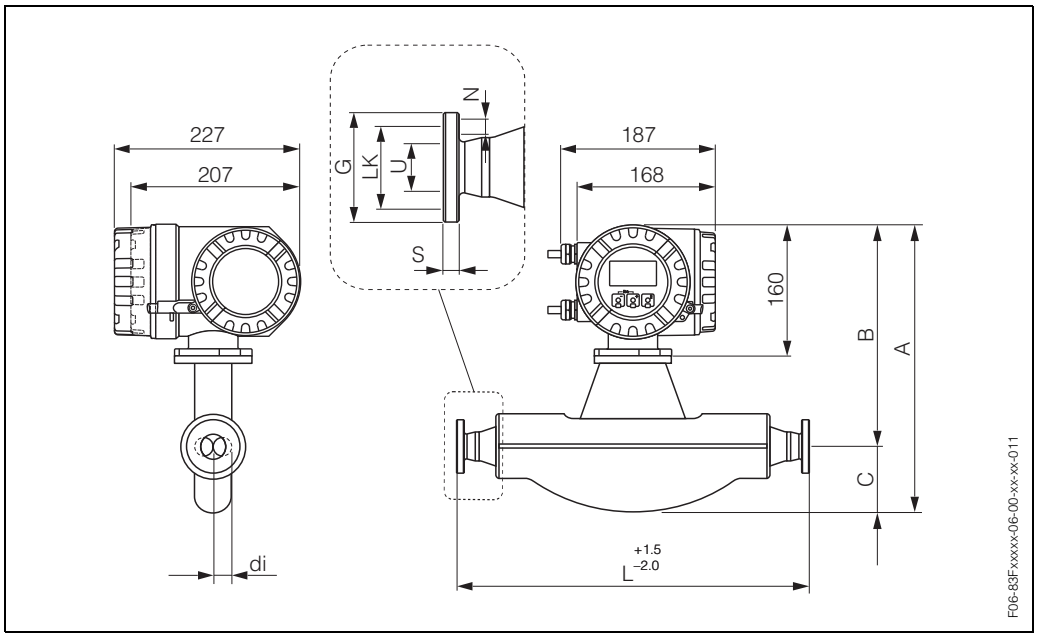


Fig. 61: Dimensions Promass F: flange connections DIN 11864-2 Form A (flat flange)

Flange DIN 11864-2 Form A (flat flange): 1.4404/316L										
DN	A	B	C	G	L	N	S	LK	U	di
8	341	266	75	54	387	4 x Ø9	10	37	10	5.35
15	341	266	75	59	418	4 x Ø9	10	42	16	8.30
25	341	266	75	70	454	4 x Ø9	10	53	26	12.00
40	376	271	105	82	560	4 x Ø9	10	65	38	17.60
50	424	283	141	94	720	4 x Ø9	10	77	50	26.00
80	505	305	200	133	900	8 x Ø11	12	112	81	40.50
100	571	324	247	159	1128	8 x Ø11	14	137	100	51.20
3A version also available (Ra ≤ 0.8 µm/150 grit. Option: Ra ≤ 0.4 µm/240 grit)										

Dimensions Promass F: ISO 2853 connections (couplings)

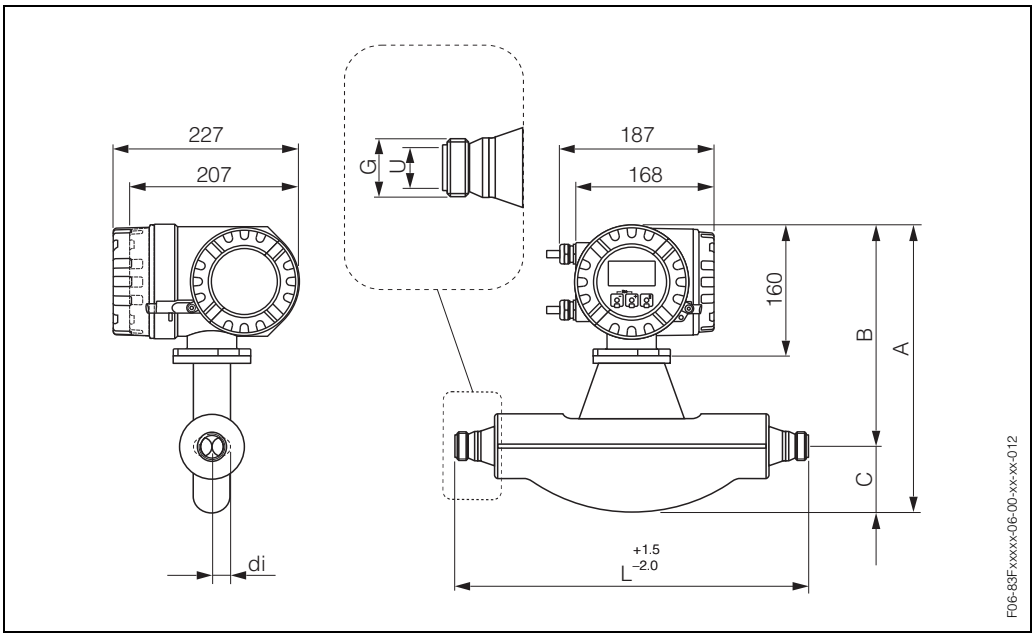


Fig. 62: Dimensions Promass F: ISO 2853 connections (couplings)

Coupling ISO 2853: 1.4404/316L							
DN	A	B	C	G [1]	L	U	di
8	341	266	75	37.13	367	22.6	5.35
15	341	266	75	37.13	398	22.6	8.30
25	341	266	75	37.13	434	22.6	12.00
40	376	271	105	52.68	560	35.6	17.60
50	424	283	141	64.16	720	48.6	26.00
80	505	305	200	91.19	900	72.9	40.50
100	571	324	247	118.21	1128	97.6	51.20
[1] Max. thread diameter to ISO 2853 Annex A 3A version also available (Ra ≤ 0.8 µm/150 grit. Option: Ra ≤ 0.4 µm/240 grit)							

Dimensions Promass F: SMS 1145 connections (hygienic coupling)

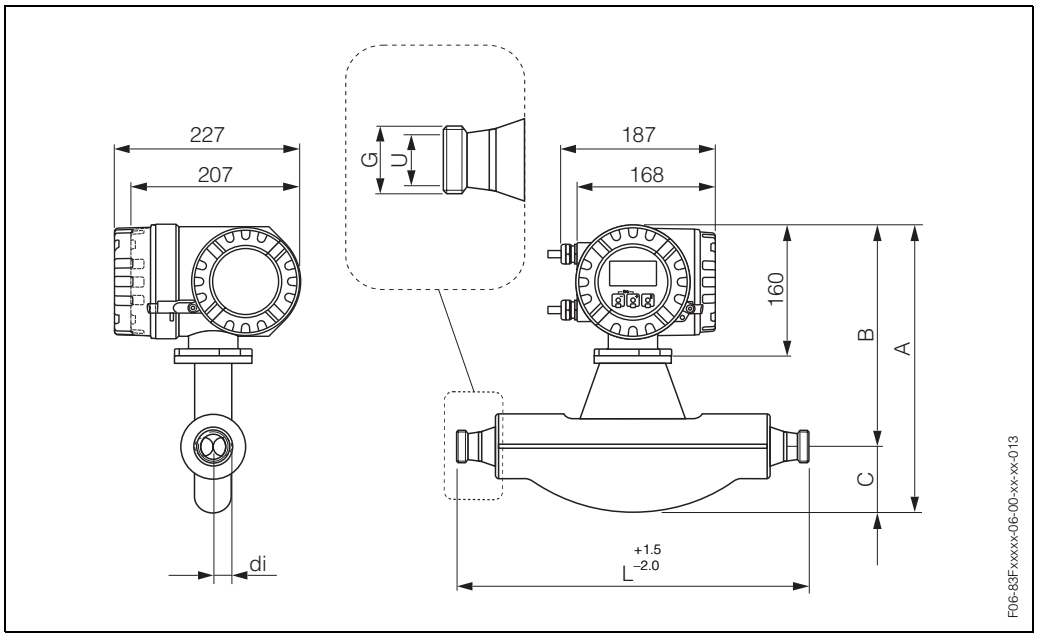


Fig. 63: Dimensions Promass F: SMS 1145 connections (hygienic coupling)

Hygienic coupling SMS 1145: 1.4404/316L							
DN	A	B	C	G	L	U	di
8	341	266	75	Rd 40 x 1/6"	367	22.5	5.35
15	341	266	75	Rd 40 x 1/6"	398	22.5	8.30
25	341	266	75	Rd 40 x 1/6"	434	22.5	12.00
40	376	271	105	Rd 60 x 1/6"	560	35.5	17.60
50	424	283	141	Rd 70 x 1/6"	720	48.5	26.00
80	505	305	200	Rd 98 x 1/6"	900	72.0	40.50
100	571	324	247	Rd 132 x 1/6"	1128	97.5	51.20
3A version also available (Ra ≤ 0.8 µm/150 grit)							

Dimensions Promass F:
Purge connections / secondary containment monitoring
(Not available for the Promass F high-temperature version)

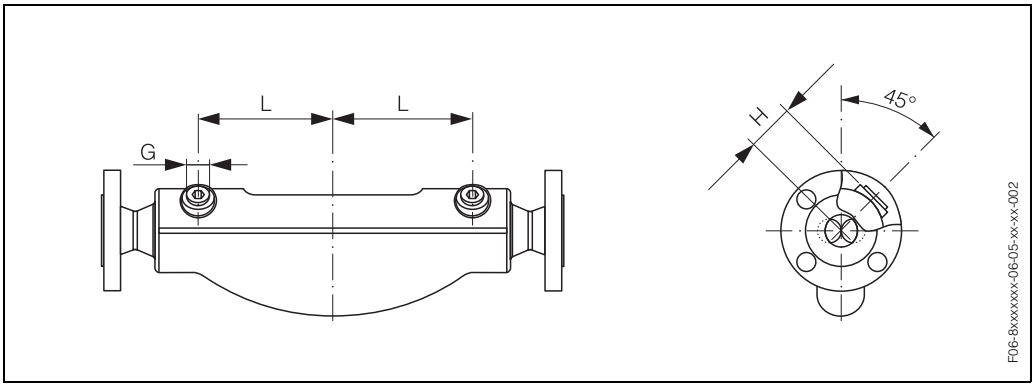


Fig. 64: Dimensions Promass F: purge connections / secondary containment monitoring

DN	L	H	G
8	108	62	1/2" NPT
15	110	62	1/2" NPT
25	130	62	1/2" NPT
40	155	67	1/2" NPT
50	226	79	1/2" NPT
80	280	101	1/2" NPT
100	342	115	1/2" NPT
150	440	121	1/2" NPT

10.10 Dimensions: Promass M

Dimensions Promass M: flange connections EN (DIN), ANSI, JIS

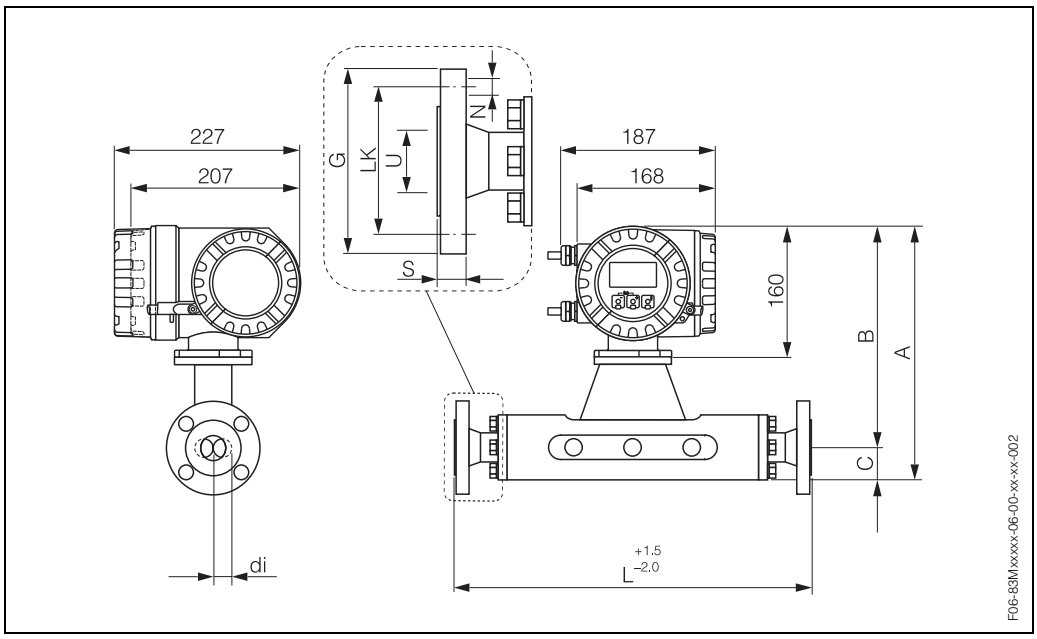


Fig. 65: Dimensions Promass M: flange connections EN (DIN), ANSI, JIS

Flange EN 1092-1 (DIN 2501) / PN 16: PVDF										
DN	A	B	C	G	L	N	S	LK	U	di
8	301	266	35	95	370	4 x Ø14	16	65	16.1	5.53
15	305	268	37	95	404	4 x Ø14	16	65	16.1	8.55
25	312	272	40	115	440	4 x Ø14	18	85	28.5	11.38
40	332	283	49	150	550	4 x Ø18	18	110	43.1	17.07
50	351	293	58	165	715	4 x Ø18	20	125	54.5	25.60

Flange EN 1092-1 (DIN 2501 / DIN 2512N [1]) / PN 40: 1.4404/316L, titanium Surface roughness (flange): EN 1092-1 Form B1 (DIN 2526 Form C), Ra 6.3...12.5 µm										
DN	A	B	C	G	L	N	S	LK	U	di
8	301	266	35	95	370	4 x Ø14	16	65	17.3	5.53
15	305	268	37	95	404	4 x Ø14	16	65	17.3	8.55
25	312	272	40	115	440	4 x Ø14	18	85	28.5	11.38
40	332	283	49	150	550	4 x Ø18	18	110	43.1	17.07
50	351	293	58	165	715	4 x Ø18	20	125	54.5	25.60
80	385	309	76	200	840	8 x Ø18	24	160	82.5	38.46
[1] Flange with groove to EN 1092-1 Form D (DIN 2512N) available										

Flange EN 1092-1 (DIN 2501) / PN 40 (with DN 25 flanges): 1.4404/316L Surface roughness (flange): EN 1092-1 Form B1 (DIN 2526 Form C), Ra 6.3...12.5 µm										
DN	A	B	C	G	L	N	S	LK	U	di
8	301	266	35	115	440	4 x Ø14	18	85	28.5	5.53
15	305	268	37	115	440	4 x Ø14	18	85	28.5	8.55

Flange EN 1092-1 (DIN 2501 / DIN 2512N [1]) / PN 64: 1.4404/316L, titanium
Surface roughness (flange): EN 1092-1 Form B2 (DIN 2526 Form E), Ra 1.6...3.2 µm

DN	A	B	C	G	L	N	S	LK	U	di
50	351	293	58	180	724	4 x Ø22	26	135	54.5	25.60
80	385	309	76	215	875	8 x Ø22	28	170	81.7	38.46

[1] Flange with groove to EN 1092-1 Form D (DIN 2512N) available

Flange EN 1092-1 (DIN 2501 / DIN 2512N [1]) / PN 100: 1.4404/316L, titanium
Surface roughness (flange): EN 1092-1 Form B2 (DIN 2526 Form E), Ra 1.6...3.2 µm

DN	A	B	C	G	L	N	S	LK	U	di
8	301	266	35	95	400	4 x Ø14	20	65	17.3	5.53
15	305	268	37	95	420	4 x Ø14	20	65	17.3	8.55
25	312	272	40	115	470	4 x Ø14	24	85	28.5	11.38
40	332	283	49	150	590	4 x Ø18	26	110	43.1	17.07
50	351	293	58	165	740	4 x Ø18	28	125	54.5	25.60
80	385	309	76	230	885	8 x Ø26	32	180	80.9	38.46

[1] Flange with groove to EN 1092-1 Form D (DIN 2512N) available

Flange ANSI B16.5 / Cl 150: 1.4404/316L, titanium
Surface roughness (flange): Ra 3.2...6.3 µm

DN		A	B	C	G	L	N	S	LK	U	di
8	3/8"	301	266	35	88.9	370	4 x Ø15.7	11.2	60.5	15.7	5.53
15	1/2"	305	268	37	88.9	404	4 x Ø15.7	11.2	60.5	15.7	8.55
25	1"	312	272	40	108.0	440	4 x Ø15.7	14.2	79.2	26.7	11.38
40	1 1/2"	332	283	49	127.0	550	4 x Ø15.7	17.5	98.6	40.9	17.07
50	2"	351	293	58	152.4	715	4 x Ø19.1	19.1	120.7	52.6	25.60
80	3"	385	309	76	190.5	840	4 x Ø19.1	23.9	152.4	78.0	38.46

Flange ANSI B16.5 / Cl 150: PVDF

DN		A	B	C	G	L	N	S	LK	U	di
8	3/8"	301	266	35	88.9	370	4 x Ø15.7	16	60.5	15.7	5.53
15	1/2"	305	268	37	88.9	404	4 x Ø15.7	16	60.5	15.7	8.55
25	1"	312	272	40	108.0	440	4 x Ø15.7	18	79.2	26.7	11.38
40	1 1/2"	332	283	49	127.0	550	4 x Ø15.7	21	98.6	40.9	17.07
50	2"	351	293	58	152.4	715	4 x Ø19.1	28	120.7	52.6	25.60

Flange ANSI B16.5 / Cl 300: 1.4404/316L, titanium
Surface roughness (flange): Ra 3.2...6.3 µm

DN		A	B	C	G	L	N	S	LK	U	di
8	3/8"	301	266	35	95.2	370	4 x Ø15.7	14.2	66.5	15.7	5.53
15	1/2"	305	268	37	95.2	404	4 x Ø15.7	14.2	66.5	15.7	8.55
25	1"	312	272	40	123.9	440	4 x Ø19.0	17.5	88.9	26.7	11.38
40	1 1/2"	332	283	49	155.4	550	4 x Ø22.3	20.6	114.3	40.9	17.07
50	2"	351	293	58	165.1	715	8 x Ø19.0	22.3	127.0	52.6	25.60
80	3"	385	309	76	209.5	840	8 x Ø22.3	28.4	168.1	78.0	38.46

Flange ANSI B16.5 / Cl 600: 1.4404/316L, titanium
Surface roughness (flange): Ra 3.2...6.3 µm

DN		A	B	C	G	L	N	S	LK	U	di
8	3/8"	301	266	35	95.3	400	4 x Ø15.7	20.6	66.5	13.8	5.53
15	1/2"	305	268	37	95.3	420	4 x Ø15.7	20.6	66.5	13.8	8.55
25	1"	312	272	40	124.0	490	4 x Ø19.1	23.6	88.9	24.4	11.38
40	1 1/2"	332	283	49	155.4	600	4 x Ø22.4	28.7	114.3	38.1	17.07
50	2"	351	293	58	165.1	742	8 x Ø19.1	31.8	127.0	49.3	25.60
80	3"	385	309	76	209.6	900	8 x Ø22.4	38.2	168.1	73.7	38.46

Flange JIS B2238 / 10K: 1.4404/316L, titanium
Surface roughness (flange): Ra 3.2...6.3 µm

DN	A	B	C	G	L	N	S	LK	U	di
50	351	293	49.25	155	715	4 x Ø19	16	120	50	25.60
80	385	309	58	185	832	8 x Ø19	18	150	80	38.46

Flange JIS B2238 / 10K: PVDF

DN	A	B	C	G	L	N	S	LK	U	di
8	301	266	35	95	370	4 x Ø15	16	70	15	5.53
15	305	268	37	95	404	4 x Ø15	16	70	15	8.55
25	312	272	40	125	440	4 x Ø19	18	90	25	11.38
40	332	283	49	140	550	4 x Ø19	21	105	40	17.07
50	351	293	58	155	715	4 x Ø19	22	120	50	25.60

Flange JIS B2238 / 20K: 1.4404/316L, titanium
Surface roughness (flange): Ra 3.2...6.3 µm

DN	A	B	C	G	L	N	S	LK	U	di
8	301	266	35	95	370	4 x Ø15	14	70	15	5.53
15	305	268	37	95	404	4 x Ø15	14	70	15	8.55
25	312	272	40	125	440	4 x Ø19	16	90	25	11.38
40	332	283	49	140	550	4 x Ø19	18	105	40	17.07
50	351	293	58	155	715	8 x Ø19	18	120	50	25.60
80	385	309	76	200	832	8 x Ø23	22	160	80	38.46

Flange JIS B2238 / 40K: 1.4404/316L, titanium
Surface roughness (flange): Ra 3.2...6.3 µm

DN	A	B	C	G	L	N	S	LK	U	di
8	301	266	35	115	400	4 x Ø19	20	80	15	5.53
15	305	268	37	115	425	4 x Ø19	20	80	15	8.55
25	312	272	40	130	485	4 x Ø19	22	95	25	11.38
40	332	283	49	160	600	4 x Ø23	24	120	38	17.07
50	351	293	58	165	760	8 x Ø19	26	130	50	25.60
80	385	309	76	210	890	8 x Ø23	32	170	75	38.46

Flange JIS B2238 / 63K: 1.4404/316L, titanium Surface roughness (flange): Ra 3.2...6.3 µm										
DN	A	B	C	G	L	N	S	LK	U	di
8	301	266	35	120	420	4 x Ø19	23	85	12	5.53
15	305	268	37	120	440	4 x Ø19	23	85	12	8.55
25	312	272	40	140	494	4 x Ø23	27	100	22	11.38
40	332	283	49	175	620	4 x Ø25	32	130	35	17.07
50	351	293	58	185	775	8 x Ø23	34	145	48	25.60
80	385	309	76	230	915	8 x Ø25	40	185	73	38.46

Dimensions Promass M: Tri-Clamp connections

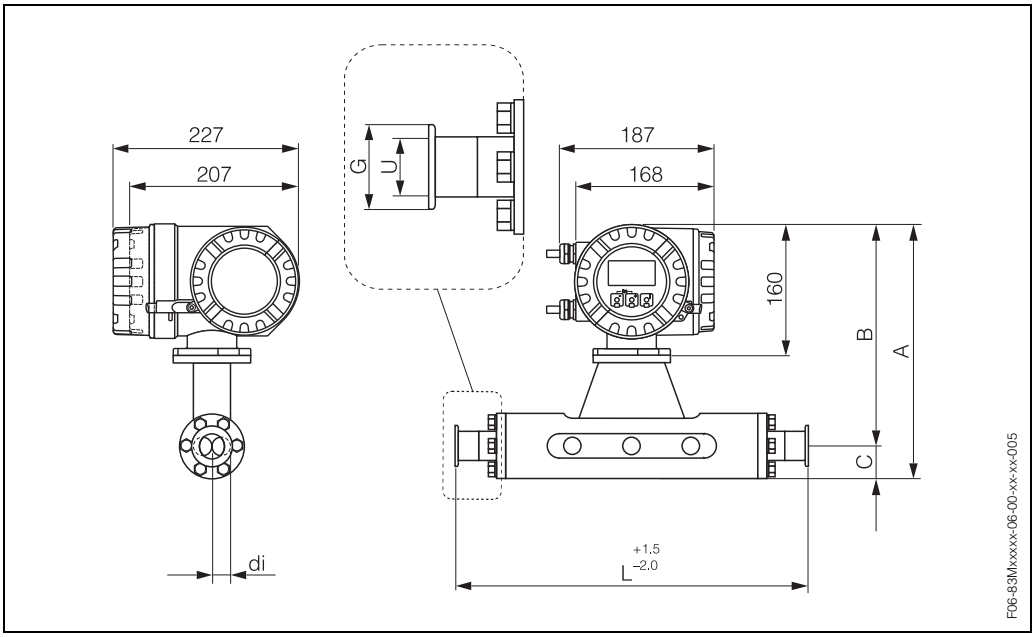


Fig. 66: Dimensions Promass M: Tri-Clamp connections

Tri-Clamp: 1.4404/316L								
DN	Clamp	A	B	C	G	L	U	di
8	1"	301	266	35	50.4	367	22.1	5.53
15	1"	305	268	37	50.4	398	22.1	8.55
25	1"	312	272	40	50.4	434	22.1	11.38
40	1 1/2"	332	283	49	50.4	560	34.8	17.07
50	2"	351	293	58	63.9	720	47.5	25.60
80	3"	385	309	76	90.9	801	72.9	38.46
3A version also available (Ra ≤ 0.8 µm/150 grit)								

1/2" Tri-Clamp: 1.4404/316L								
DN	Clamp	A	B	C	G	L	U	di
8	1"	301	266	35	25.0	367	9.5	5.53
15	1"	305	268	37	25.0	398	9.5	8.55
3A version also available (Ra ≤ 0.8 µm/150 grit)								

Dimensions Promass M: DIN 11851 connections (hygienic coupling)

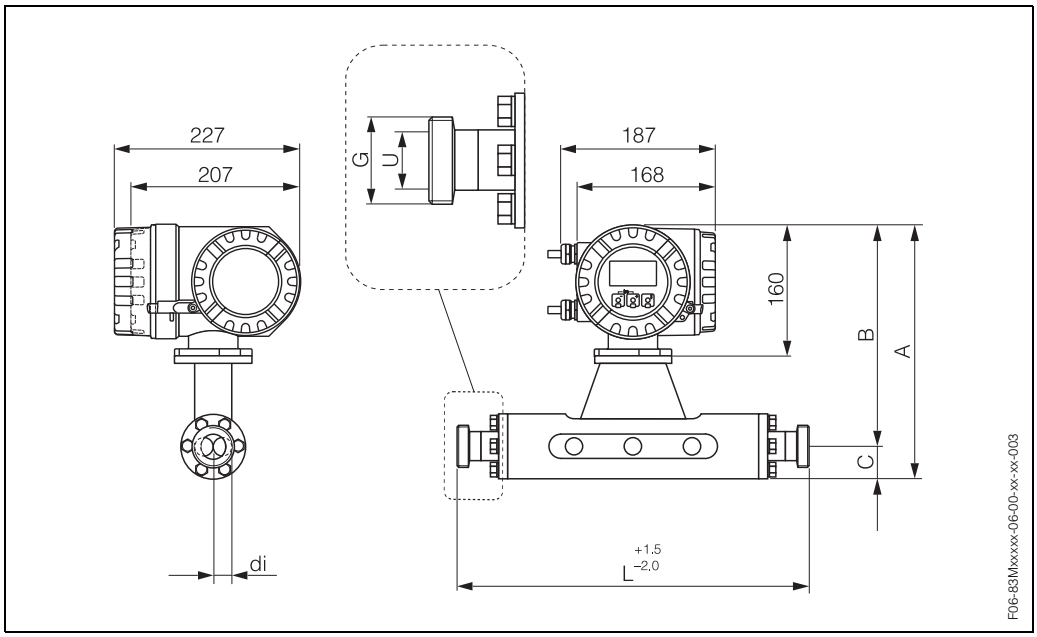


Fig. 67: Dimensions Promass M: DIN 11851 connections (hygienic coupling)

Hygienic coupling DIN 11851: 1.4404/316L							
DN	A	B	C	G	L	U	di
8	301	266	35	Rd 34 x 1/8"	367	16	5.53
15	305	268	37	Rd 34 x 1/8"	398	16	8.55
25	312	272	40	Rd 52 x 1/6"	434	26	11.38
40	332	283	49	Rd 65 x 1/6"	560	38	17.07
50	351	293	58	Rd 78 x 1/6"	720	50	25.60
80	385	309	76	Rd 110 x 1/4"	815	81	38.46
3A version also available (Ra ≤ 0.8 µm/150 grit)							

Dimensions Promass M: DIN 11864-1 Form A connections (couplings)

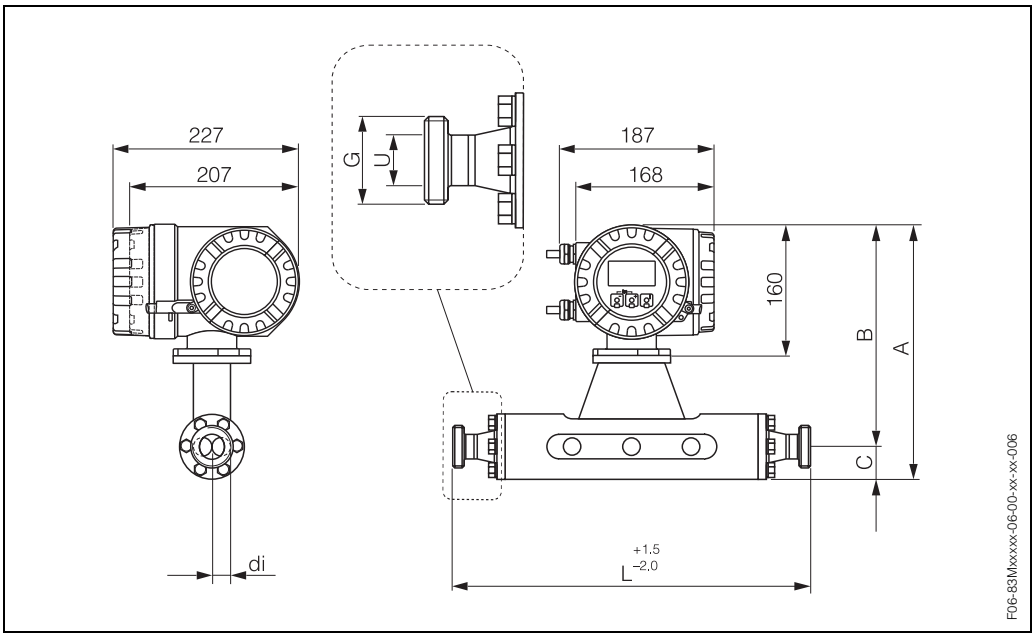


Fig. 68: Dimensions Promass M: DIN 11864-1 Form A connections (couplings)

Coupling DIN 11864-1 Form A: 1.4404/316L							
DN	A	B	C	G	L	U	di
8	301	266	35	Rd 28x 1/8"	367	10	5.53
15	305	268	37	Rd 34 x 1/8"	398	16	8.55
25	312	272	40	Rd 52 x 1/6"	434	26	11.38
40	332	283	49	Rd 65 x 1/6"	560	38	17.07
50	351	293	58	Rd 78 x 1/6"	720	50	25.60
80	385	309	76	Rd 110 x 1/4"	815	81	38.46
3A version also available (Ra ≤ 0.8 µm/150 grit)							

Dimensions Promass M: flange connections DIN 11864-2 Form A (flat flange)

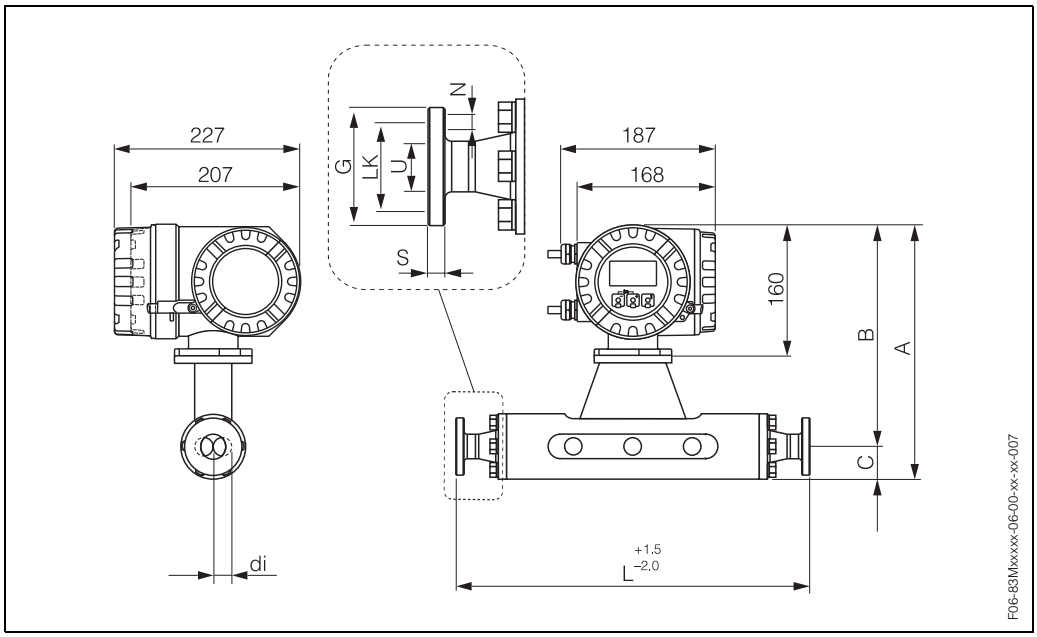


Fig. 69: Dimensions Promass M: flange connections DIN 11864-2 Form A (flat flange)

Flange DIN 11864-2 Form A (flat flange): 1.4404/316L										
DN	A	B	C	G	L	N	S	LK	U	di
8	301	266	35	54	367	4 x Ø9	10	37	10	5.53
15	305	268	37	59	398	4 x Ø9	10	42	16	8.55
25	312	272	40	70	434	4 x Ø9	10	53	26	11.38
40	332	283	49	82	560	4 x Ø9	10	65	38	17.07
50	351	293	58	94	720	4 x Ø9	10	77	50	25.60
80	385	309	76	133	815	8 x Ø11	12	112	81	38.46
3A version also available (Ra ≤ 0.8 µm/150 grit)										

Dimensions Promass M: ISO 2853 connections (couplings)

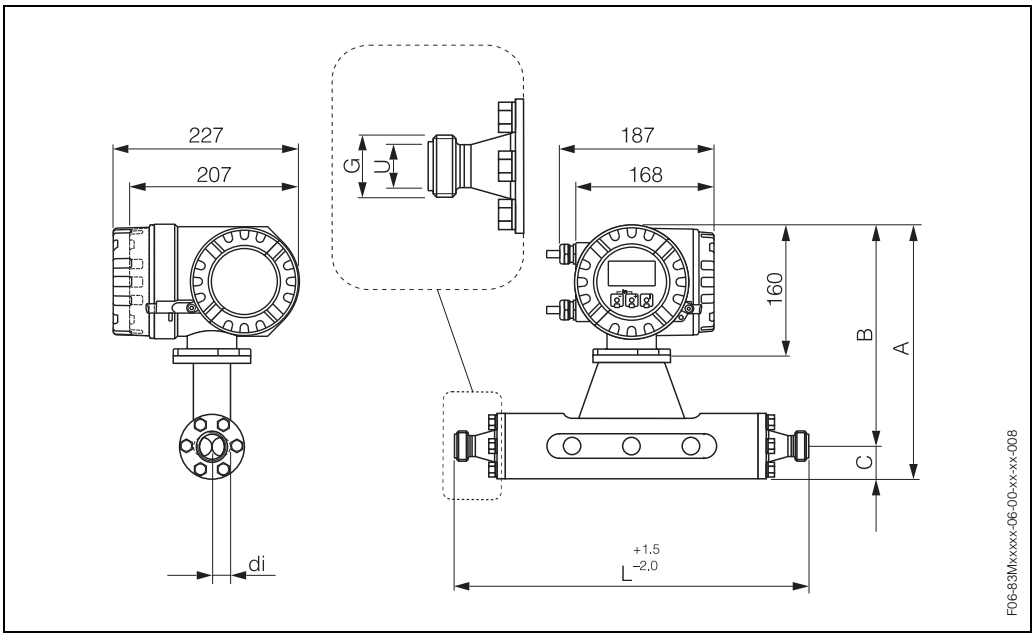


Fig. 70: Dimensions Promass M: ISO 2853 connections (couplings)

Coupling ISO 2853: 1.4404/316L							
DN	A	B	C	G [1]	L	U	di
8	301	266	35	37.13	367	22.6	5.53
15	305	268	37	37.13	398	22.6	8.55
25	312	272	40	37.13	434	22.6	11.38
40	332	283	49	52.68	560	35.6	17.07
50	351	293	58	64.16	720	48.6	25.60
80	385	309	76	91.19	815	72.9	38.46

[1] Max. thread diameter to ISO 2853 Annex A
3A version also available (Ra ≤ 0.8 µm/150 grit)

Dimensions Promass M: SMS 1145 connections (hygienic coupling)

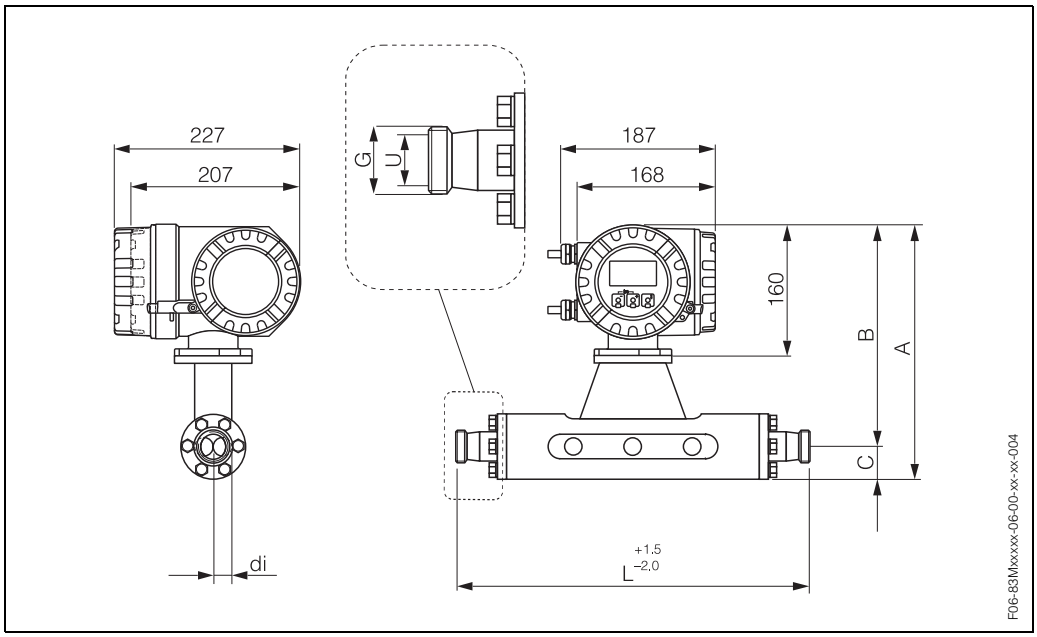


Fig. 71: Dimensions Promass M: SMS 1145 connections (hygienic coupling)

Hygienic coupling SMS 1145: 1.4404/316L							
DN	A	B	C	G	L	U	di
8	301	266	35	Rd 40 x 1/6"	367	22.5	5.53
15	305	268	37	Rd 40 x 1/6"	398	22.5	8.55
25	312	272	40	Rd 40 x 1/6"	434	22.5	11.38
40	332	283	49	Rd 40 x 1/6"	560	35.5	17.07
50	351	293	58	Rd 70 x 1/6"	720	48.5	25.60
80	385	309	76	Rd 98 x 1/6"	792	72.0	38.46
3A version also available (Ra ≤ 0.8 µm/150 grit)							

Dimensions Promass M (high-pressure):
1/2" NPT, 3/8" NPT and G 3/8" connections

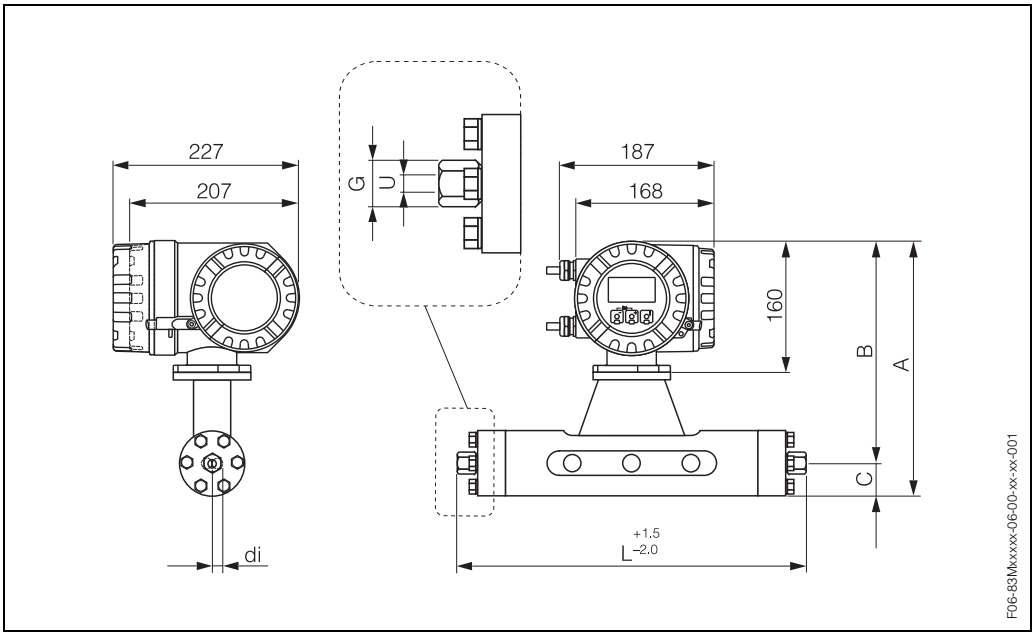


Fig. 72: Dimensions Promass M (high pressure): 1/2" NPT, 3/8" NPT and G 3/8" connections

1/2" NPT: 1.4404/316L							
DN	A	B	C	G	L	U	di
8	301	266	35	SW 1 1/16"	370	10.2	4.93
15	305	268	37	SW 1 1/16"	400	10.2	7.75
25	312	272	40	SW 1 1/16"	444	10.2	10.20

3/8" NPT: 1.4404/316L							
DN	A	B	C	G	L	U	di
8	301	266	35	SW 1 5/16"	355.8	10.2	4.93
15	305	268	37	SW 1 5/16"	385.8	10.2	7.75
25	312	272	40	SW 1 5/16"	429.8	10.2	10.20

G 3/8": 1.4404/316L							
DN	A	B	C	G	L	U	di
8	301	266	35	SW 24	355.8	10.2	4.93
15	305	268	37	SW 24	385.8	10.2	7.75
25	312	272	40	SW 24	429.8	10.2	10.20

Dimensions Promass M (high pressure): 1/2" SWAGELOK connection

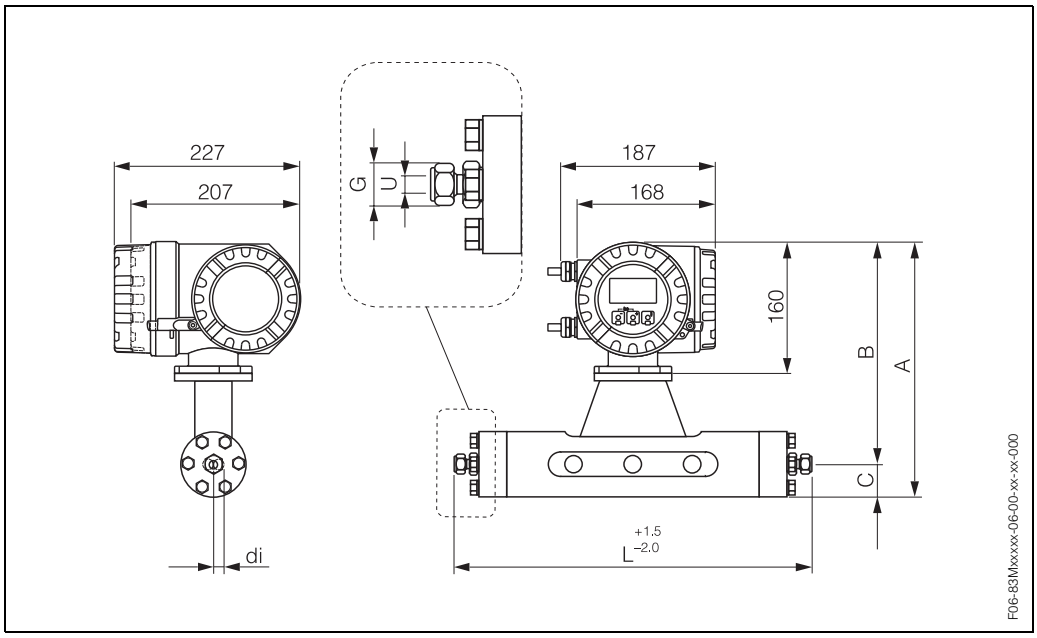


Fig. 73: Dimensions Promass M (high pressure): 1/2" SWAGELOK connection

1/2" SWAGELOK: 1.4404/316L							
DN	A	B	C	G	L	U	di
8	301	266	35	7/8"	366.4	10.2	4.93
15	305	268	37	7/8"	396.4	10.2	7.75
25	312	272	40	7/8"	440.4	10.2	10.20

Dimensions Promass M (high-pressure):
Connector with 7/8-14UNF internal pipe thread

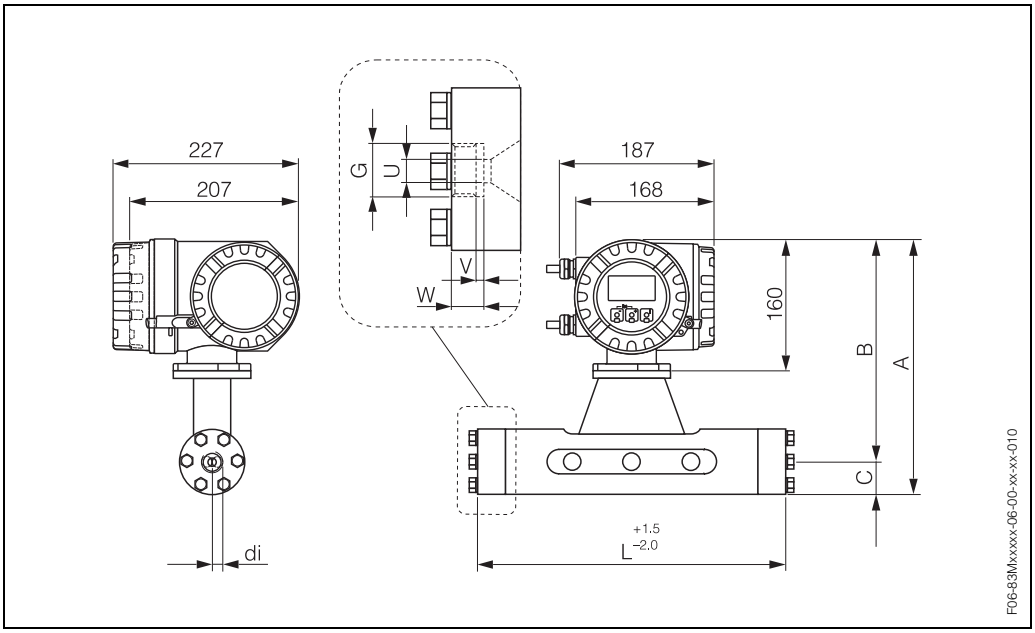


Fig. 74: Dimensions Promass M (high pressure): Connector with 7/8-14UNF internal pipe thread

Internal pipe thread 7/8-14UNF: 1.4404/316L									
DN	A	B	C	G	L	U	V	W	di
8	301	266	35	7/8-14UNF	304	10.2	3	14	4.93
15	305	268	37	7/8-14UNF	334	10.2	3	14	7.75
25	312	272	40	7/8-14UNF	378	10.2	3	14	10.20

Dimensions Promass M: without process connections

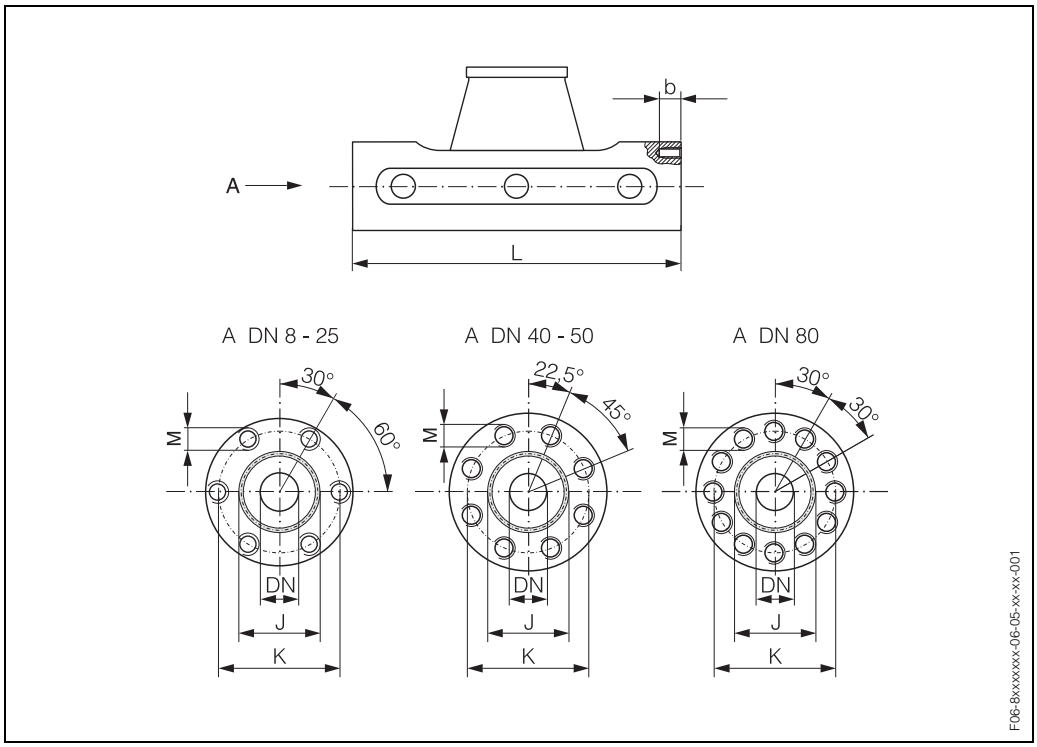


Fig. 75: Dimensions Promass M: without process connections

DN	L	J	K	M	$b_{max.}$	$b_{min.}$
8	256	27	54	6 x M 8	12	10
8 [1)]	256	27	54	6 x M 8	12	10
15	286	35	56	6 x M 8	12	10
15 [1)]	286	35	56	6 x M 8	12	10
25	310	40	62	6 x M 8	12	10
25 [1)]	310	40	62	6 x M 8	12	10
40	410	53	80	8 x M 10	15	13
50	544	73	94	8 x M 10	15	13
80	644	102	128	12 x M 12	18	15
[1)] High pressure version; permissible thread: A4 - 80; lubricant: Molykote P37						

	Tightening torque	**Lubricated thread**	**O-ring**	
DN	Nm	yes/no	Thickness	Inside Ø
8	30.0	no	2.62	21.89
8 [1)]	19.3	yes	2.62	21.89
15	30.0	no	2.62	29.82
15 [1)]	19.3	yes	2.62	29.82
25	30.0	no	2.62	34.60
25 [1)]	19.3	yes	2.62	34.60
40	60.0	no	2.62	47.30
50	60.0	yes	2.62	67.95
80	100.0	yes	3.53	94.84
[1)] High pressure version; permissible thread: A4 - 80; lubricant: Molykote P37				

Dimensions Promass M:
Purge connections / secondary containment monitoring

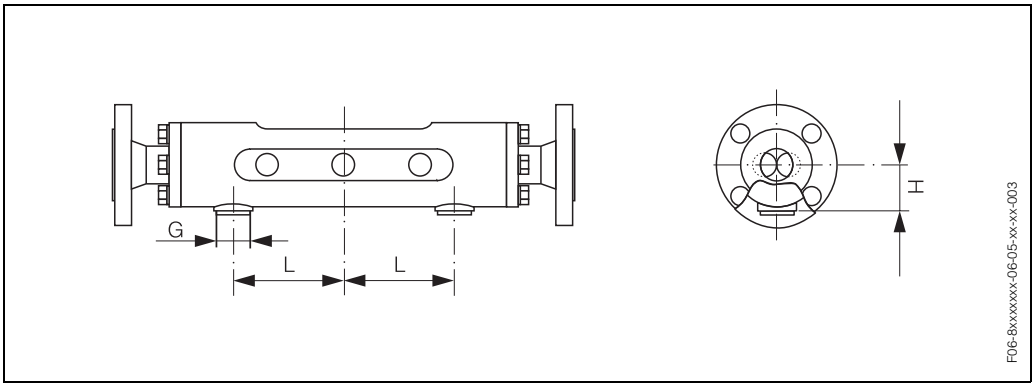


Fig. 76: Dimensions Promass M: purge connections / secondary containment monitoring

DN	L	H	G
8	85	44.0	1/2" NPT
15	100	46.5	1/2" NPT
25	110	50.0	1/2" NPT
40	155	59.0	1/2" NPT
50	210	67.5	1/2" NPT
80	210	81.5	1/2" NPT

10.11 Dimensions: Promass E

Dimensions Promass E: flange connections EN (DIN), ANSI, JIS

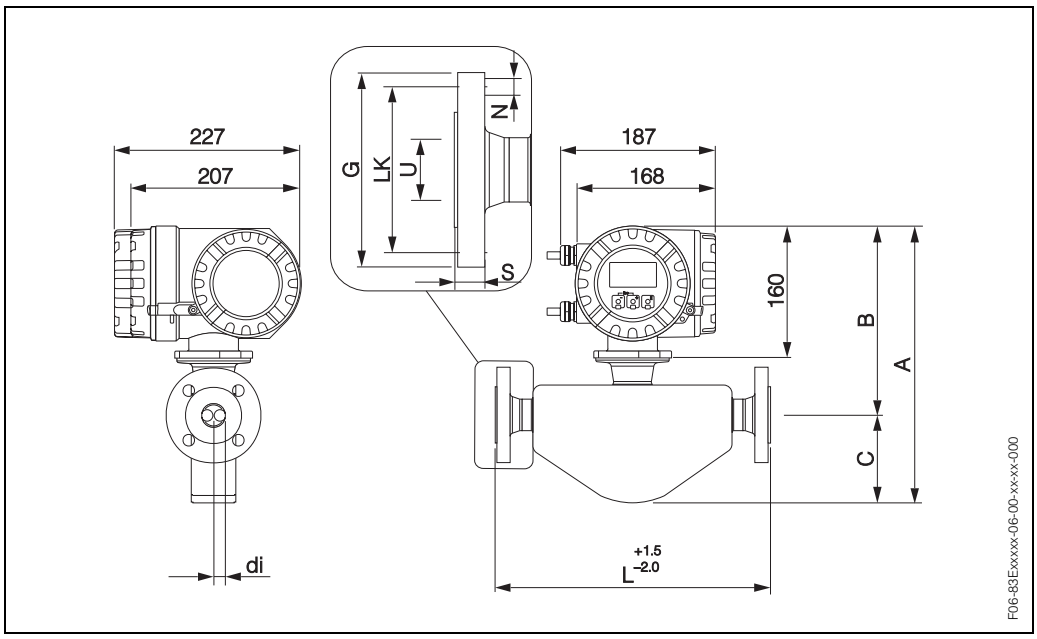


Abb. 77: Dimensions Promass E: flange connections EN (DIN), ANSI, JIS

Flange EN 1092-1 (DIN 2501 / DIN 2512N [1]) / PN 40: 1.4404/316L										
DN	A	B	C	G	L	N	S	LK	U	di
8	317	224	93	95	232	4 x Ø14	16	65	17.3	5.35
15	331	226	105	95	279	4 x Ø14	16	65	17.3	8.30
25	337	231	106	115	329	4 x Ø14	18	85	28.5	12.00
40	358	237	121	150	445	4 x Ø18	18	110	43.1	17.60
50	423	253	170	165	556	4 x Ø18	20	125	54.5	26.00
[1] Flange with groove to EN 1092-1 Form D (DIN 2512N) available										

Flange EN 1092-1 (DIN 2501) / PN 40 (with DN 25-Flanges): 1.4404/316L										
DN	A	B	C	G	L	N	S	LK	U	di
8	341	266	75	115	440	4 x Ø14	18	85	28.5	5.35
15	341	266	75	115	440	4 x Ø14	18	85	28.5	8.30

Flange EN 1092-1 (DIN 2501 / DIN 2512N [1]) / PN 63: 1.4404/316L										
DN	A	B	C	G	L	N	S	LK	U	di
50	423	253	170	180	565	4 x Ø22	26	135	54.5	26.00
[1] Flange with groove to EN 1092-1 Form D (DIN 2512N) available										

Flange EN 1092-1 (DIN 2501 / DIN 2512N [1]) / PN 100: 1.4404/316L										
DN	A	B	C	G	L	N	S	LK	U	di
8	317	224	93	105	261	4 x Ø14	20	75	17.3	5.35
15	331	226	105	105	295	4 x Ø14	20	75	17.3	8.30
25	337	231	106	140	360	4 x Ø18	24	100	28.5	12.00
40	358	237	121	170	486	4 x Ø22	26	125	42.5	17.60
50	423	253	170	195	581	4 x Ø26	28	145	53.9	26.00
[1] Flange with groove to EN 1092-1 Form D (DIN 2512N) available										

Flange ANSI B16.5 / Cl 150: 1.4404/316L											
DN		A	B	C	G	L	N	S	LK	U	di
8	3/8"	317	224	93	88.9	232	4 x Ø15.7	11.2	60.5	15.7	5.35
15	1/2"	331	226	105	88.9	279	4 x Ø15.7	11.2	60.5	15.7	8.30
25	1"	337	231	106	108.0	329	4 x Ø15.7	14.2	79.2	26.7	12.00
40	1 1/2"	358	237	121	127.0	445	4 x Ø15.7	17.5	98.6	40.9	17.60
50	2"	423	253	170	152.4	556	4 x Ø19.1	19.1	120.7	52.6	26.00

Flange ANSI B16.5 / Cl 300: 1.4404/316L											
DN		A	B	C	G	L	N	S	LK	U	di
8	3/8"	317	224	93	95.2	232	4 x Ø15.7	14.2	66.5	15.7	5.35
15	1/2"	331	226	105	95.2	279	4 x Ø15.7	14.2	66.5	15.7	8.30
25	1"	337	231	106	123.9	329	4 x Ø19.0	17.5	88.9	26.7	12.00
40	1 1/2"	358	237	121	155.4	445	4 x Ø22.3	20.6	114.3	40.9	17.60
50	2"	423	253	170	165.1	556	8 x Ø19.0	22.3	127.0	52.6	26.00

Flange ANSI B16.5 / Cl 600: 1.4404/316L											
DN		A	B	C	G	L	N	S	LK	U	di
8	3/8"	317	224	93	95.3	261	4 x Ø15.7	20.6	66.5	13.9	5.35
15	1/2"	331	226	105	95.3	295	4 x Ø15.7	20.6	66.5	13.9	8.30
25	1"	337	231	106	124.0	380	4 x Ø19.1	23.9	88.9	24.3	12.00
40	1 1/2"	358	237	121	155.4	496	4 x Ø22.4	28.7	114.3	38.1	17.60
50	2"	423	253	170	165.1	583	8 x Ø19.1	31.8	127.0	49.2	26.00

Flange JIS B2238 / 10K: 1.4404/316L										
DN	A	B	C	G	L	N	S	LK	U	di
50	423	253	170	155	556	4 x Ø19	16	120	50	26.00

Flange JIS B2238 / 20K: 1.4404/316L										
DN	A	B	C	G	L	N	S	LK	U	di
8	317	224	93	95	232	4 x Ø15	14	70	15	5.35
15	331	226	105	95	279	4 x Ø15	14	70	15	8.30
25	337	231	106	125	329	4 x Ø19	16	90	25	12.00
40	358	237	121	140	445	4 x Ø19	18	105	40	17.60
50	423	253	170	155	556	8 x Ø19	18	120	50	26.00

Flange JIS B2238 / 40K: 1.4404/316L										
DN	A	B	C	G	L	N	S	LK	U	di
8	317	224	93	115	261	4 x Ø19	20	80	15	5.35
15	331	226	105	115	300	4 x Ø19	20	80	15	8.30
25	337	231	106	130	375	4 x Ø19	22	95	25	12.00
40	358	237	121	160	496	4 x Ø23	24	120	38	17.60
50	423	253	170	165	601	8 x Ø19	26	130	50	26.00

Flange JIS B2238 / 63K: 1.4404/316L										
DN	A	B	C	G	L	N	S	LK	U	di
8	317	224	93	120	282	4 x Ø19	23	85	12	5.35
15	331	226	105	120	315	4 x Ø19	23	85	12	8.30
25	337	231	106	140	383	4 x Ø23	27	100	22	12.00
40	358	237	121	175	515	4 x Ø25	32	130	35	17.60
50	423	253	170	185	616	8 x Ø23	34	145	48	26.00

Dimensions Promass E: VCO connections

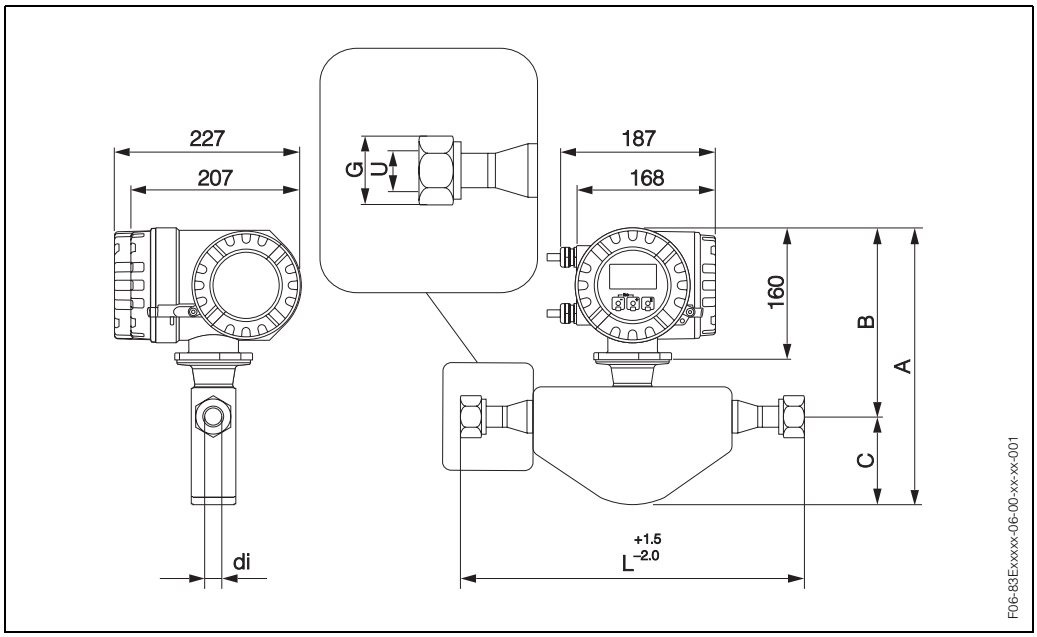


Fig. 78: Dimensions Promass E: VCO connections

8-VCO-4 (1/2"): 1.4404/316L							
DN	A	B	C	G	L	U	di
8	317	224	93	SW 1"	252	10.2	5.35

12-VCO-4 (3/4"): 1.4404/316L							
DN	A	B	C	G	L	U	di
15	331	226	105	SW 1 1/2"	305	15.7	8.30

Dimensions Promass E: Tri-Clamp connections

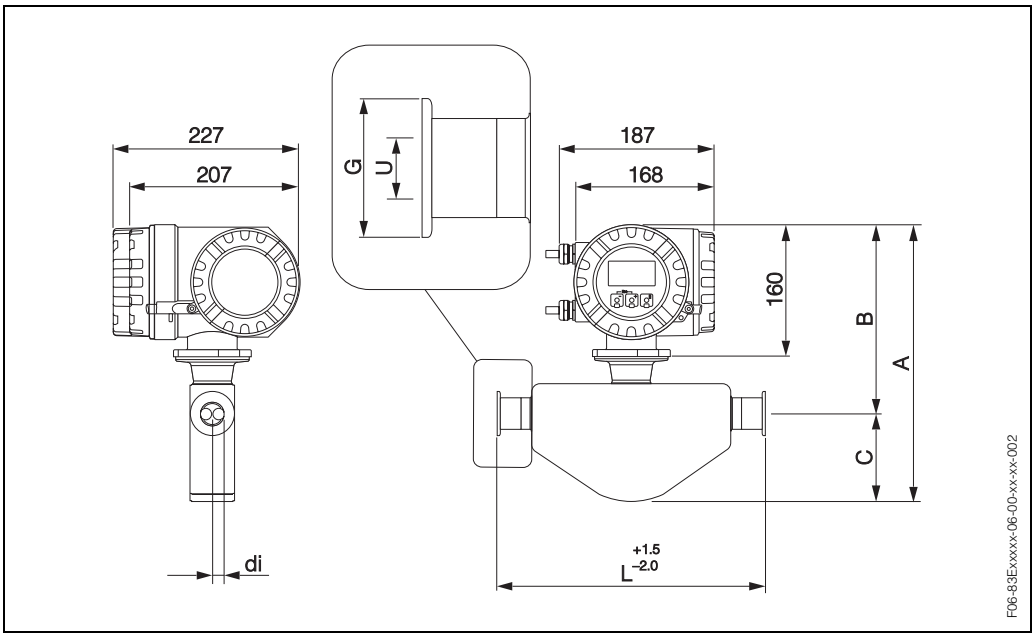


Fig. 79: Dimensions Promass E: Tri-Clamp connections

Tri-Clamp: 1.4404/316L								
DN	Clamp	A	B	C	G	L	U	di
8	1"	317	224	93	50.4	229	22.1	5.35
15	1"	331	226	105	50.4	273	22.1	8.30
25	1"	337	231	106	50.4	324	22.1	12.00
40	1 1/2"	358	237	121	50.4	456	34.8	17.60
50	2"	423	253	170	63.9	562	47.5	26.00
3A version also available (Ra ≤ 0.8 µm/150 grit)								

1/2"-Tri-Clamp: 1.4404/316L								
DN	Clamp	A	B	C	G	L	U	di
8	1/2"	317	224	93	25.0	229	9.5	5.35
15	1/2"	331	226	105	25.0	273	9.5	8.30
3A version also available (Ra ≤ 0.8 µm/150 grit)								

Dimensions Promass E: DIN 11851 connections (hygienic coupling)

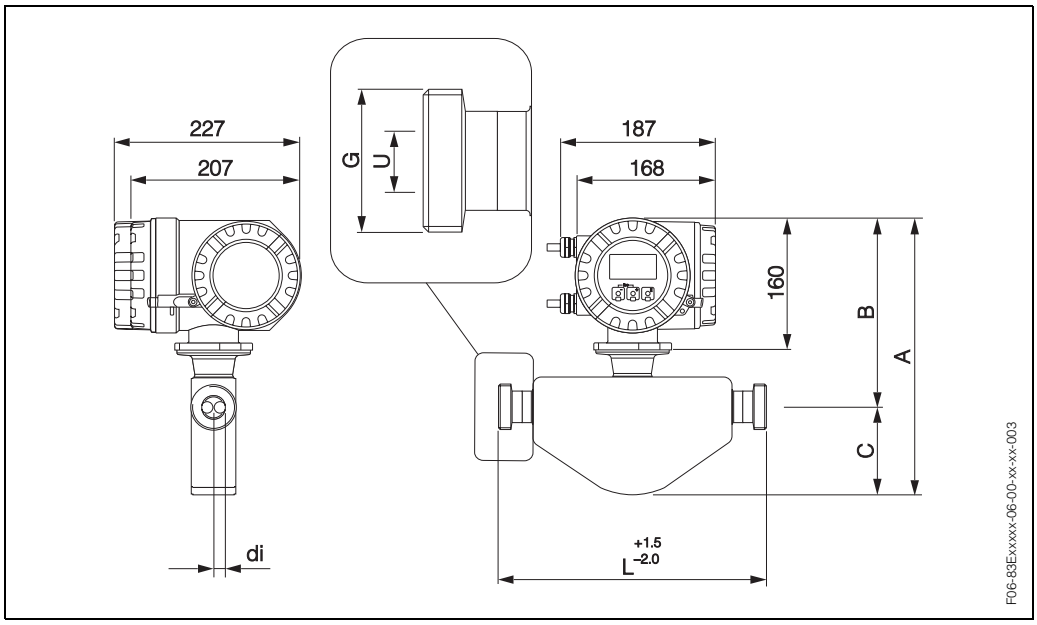


Fig. 80: Dimensions Promass E: DIN 11851 connections (hygienic coupling)

Hygienic coupling DIN 11851: 1.4404/316L							
DN	A	B	C	G	L	U	di
8	317	224	93	Rd 34 x 1/8"	229	16	5.35
15	331	226	105	Rd 34 x 1/8"	273	16	8.30
25	337	231	106	Rd 52 x 1/6"	324	26	12.00
40	358	237	121	Rd 65 x 1/6"	456	38	17.60
50	423	253	170	Rd 78 x 1/6"	562	50	26.00
3A version also available (Ra ≤ 0.8 µm/150 grit)							

Dimensions Promass E: DIN 11864-1 Form A connections (couplings)

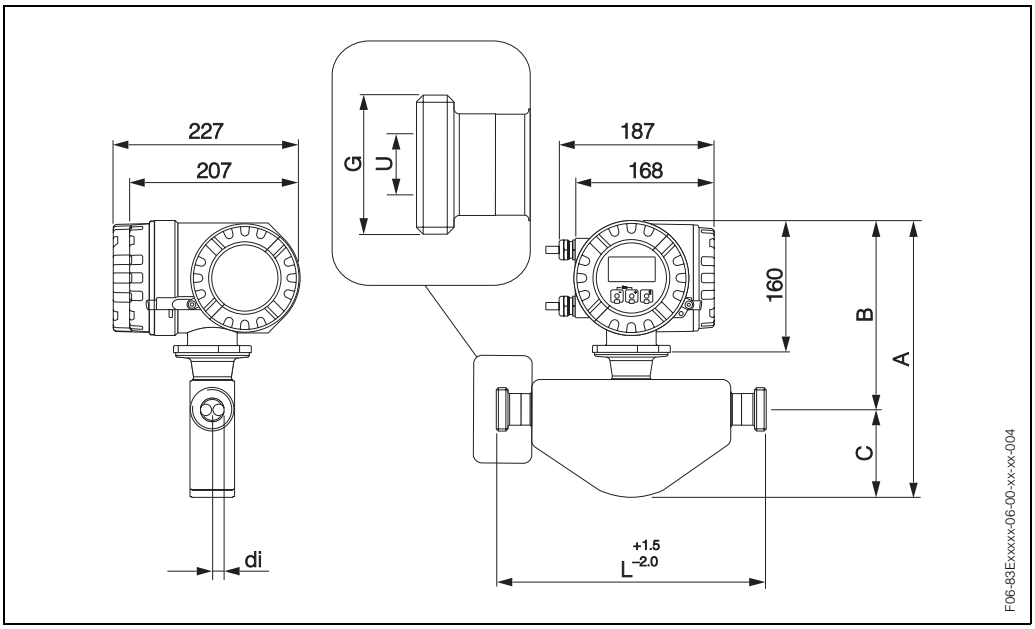


Fig. 81: Dimensions Promass E: DIN 11864-1 Form A connections (couplings)

Coupling DIN 11864-1 Form A: 1.4404/316L							
DN	A	B	C	G	L	U	di
8	317	224	93	Rd 28 x 1/8"	229	10	5.35
15	331	226	105	Rd 34 x 1/8"	273	16	8.30
25	337	231	106	Rd 52 x 1/6"	324	26	12.00
40	358	237	121	Rd 65 x 1/6"	456	38	17.60
50	423	253	170	Rd 78 x 1/6"	562	50	26.00
3A version also available (Ra ≤ 0.8 µm/150 grit)							

Dimensions Promass E: flange connection DIN 11864-2 Form A (flat flange)

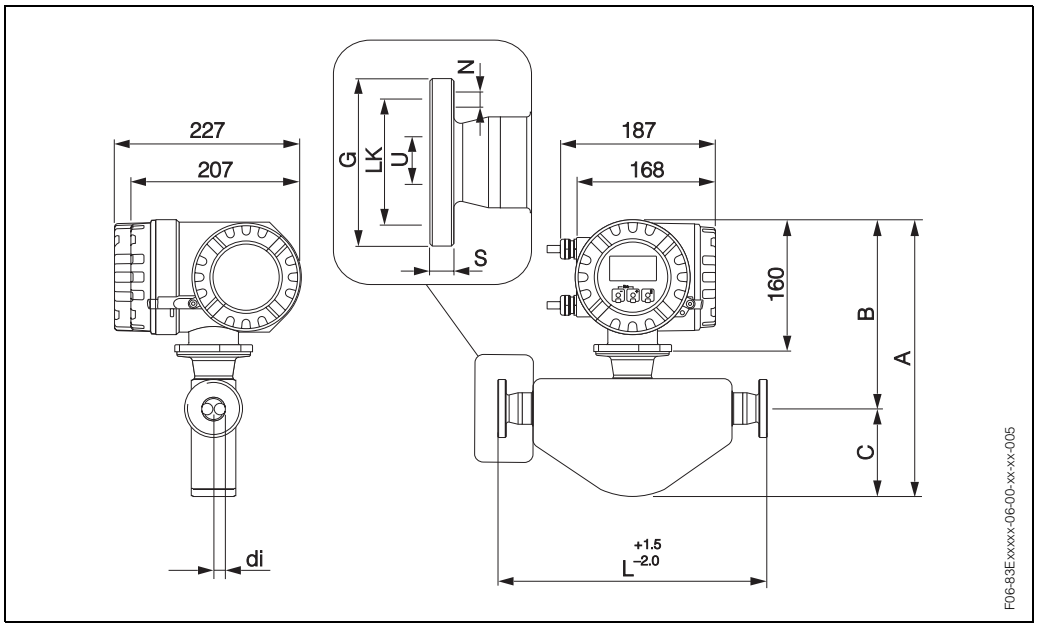


Fig. 82: Dimensions Promass E: flange connection DIN 11864-2 Form A (flat flange)

Flange DIN 11864-2 Form A (flat flange): 1.4404/316L										
DN	A	B	C	G	L	N	S	LK	U	di
8	317	224	93	54	249	4 x Ø9	10	37	10	5.35
15	331	226	105	59	293	4 x Ø9	10	42	16	8.30
25	337	231	106	70	344	4 x Ø9	10	53	26	12.00
40	358	237	121	82	456	4 x Ø9	10	65	38	17.60
50	423	253	170	94	562	4 x Ø9	10	77	50	26.00
3A version also available (Ra ≤ 0.8 µm/150 grit)										

Dimensions Promass E: ISO 2853 connection (couplings)

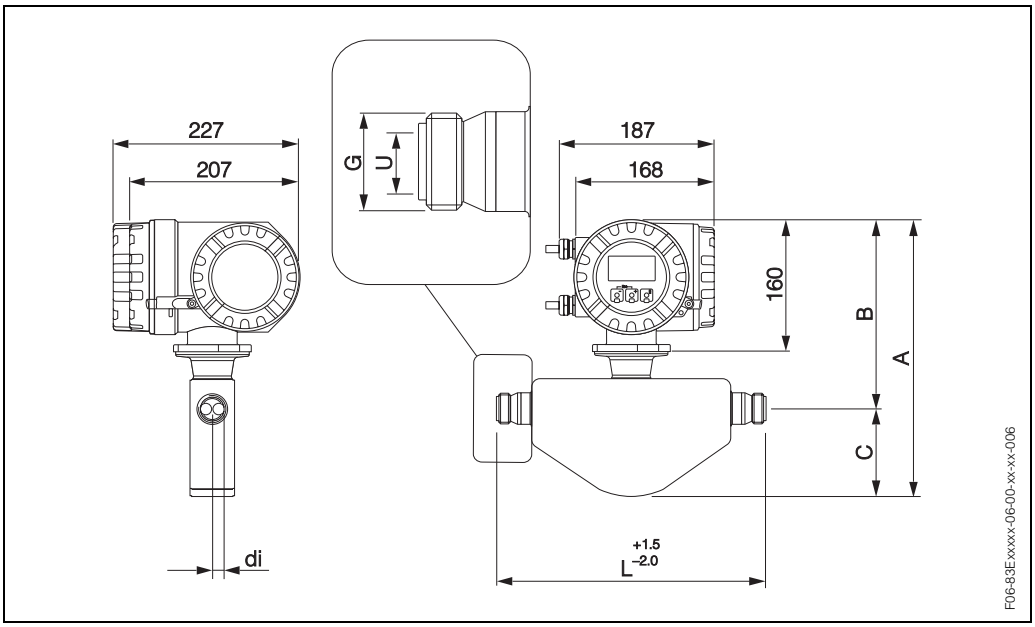


Fig. 83: Dimensions Promass E: ISO 2853 connection (couplings)

Coupling ISO 2853: 1.4404/316L							
DN	A	B	C	G [1]	L	U	di
8	317	224	93	37.13	229	22.6	5.35
15	331	226	105	37.13	273	22.6	8.30
25	337	231	106	37.13	324	22.6	12.00
40	358	237	121	52.68	456	35.6	17.60
50	423	253	170	64.16	562	48.6	26.00
[1] Max. thread diameter to ISO 2853 Annex A, 3A version also available (Ra ≤ 0.8 µm/150 grit)							

Dimensions Promass E: SMS 1145 connection (hygienic coupling)

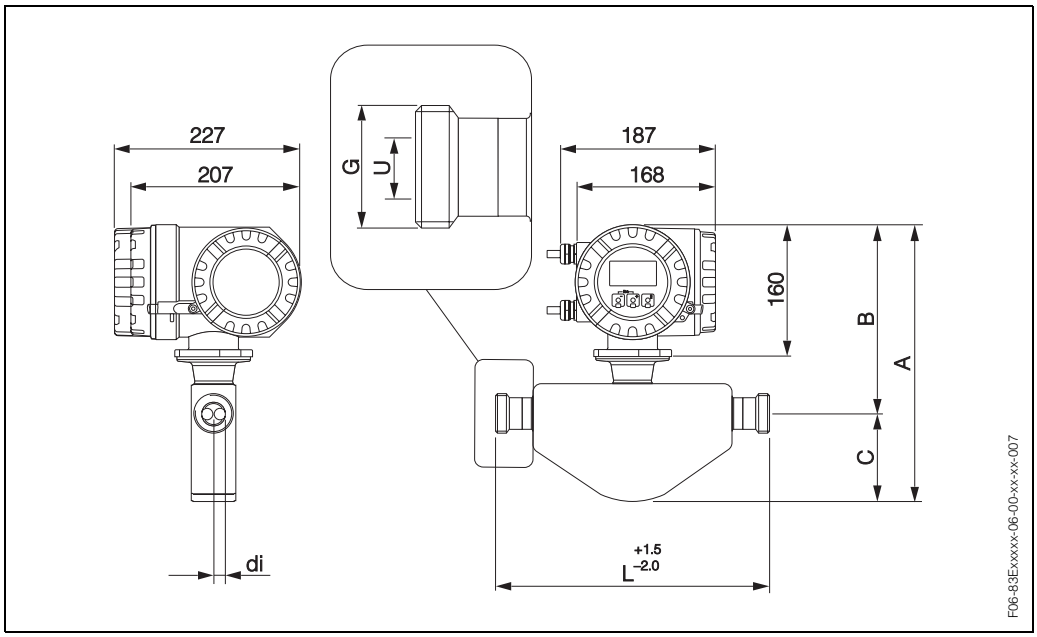


Fig. 84: Dimensions Promass E: SMS 1145 connection (hygienic coupling)

Hygienic coupling SMS 1145: 1.4404/316L							
DN	A	B	C	G	L	U	di
8	317	224	93	Rd 40 x 1/6"	229	22.5	5.35
15	331	226	105	Rd 40 x 1/6"	273	22.5	8.30
25	337	231	106	Rd 40 x 1/6"	324	22.5	12.00
40	358	237	121	Rd 60 x 1/6"	456	35.5	17.60
50	423	253	170	Rd 70 x 1/6"	562	48.5	26.00
3A version also available (Ra ≤ 0.8 µm/150 grit)							

10.12 Dimensions: Promass A

Dimensions Promass A: 4-VCO-4 connection (welded)

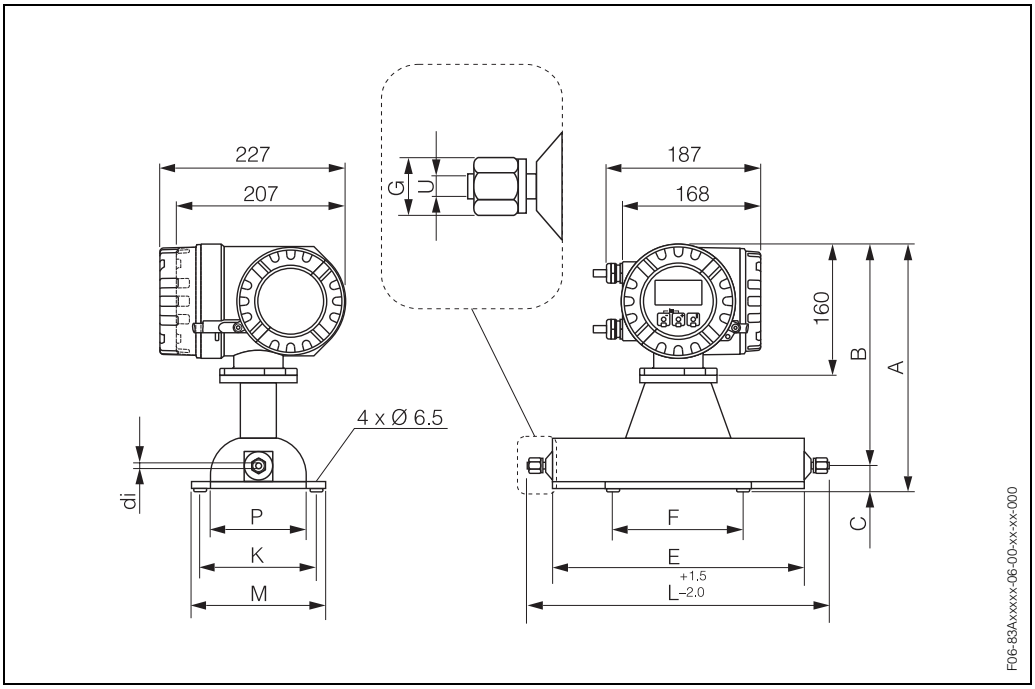


Fig. 85: Dimensions Promass A: 4-VCO-4 connection (welded)

4-VCO-4 connection: 1.4539/904L, Alloy C-22											
DN	A	B	C	E	F	G	K	L	M	P	U / di
1 [1]	305	273	32	228	160	SW 11/16"	145	290	165	120	1.1
2 [1]	305	273	32	310	160	SW 11/16"	145	372	165	120	1.8
2 [2]	305	273	32	310	160	SW 11/16"	145	372	165	120	1.4
4 [1]	315	283	32	435	220	SW 11/16"	175	497	195	150	3.5
4 [2]	315	283	32	435	220	SW 11/16"	175	497	195	150	3.0

[1] 3A version also available (Ra ≤ 0.4 µm/240 grit). For 1.4539/904L only
[2] High pressure version

Dimensions Promass A: 1/2" Tri-Clamp connection (welded)

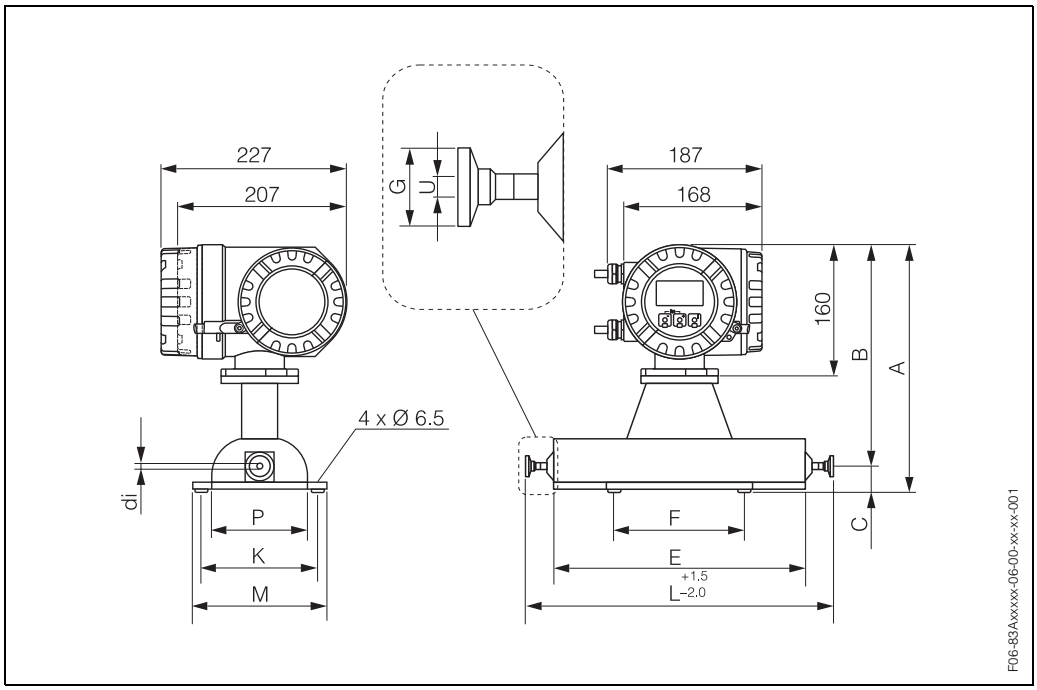


Fig. 86: Dimensions Promass A: 1/2" Tri-Clamp connection (welded)

1/2" Tri-Clamp connection / 3A version [1]: 1.4539/904L												
DN	A	B	C	E	F	G	K	L	M	P	U	di
1	305	273	32	228	160	25	145	296	165	120	9.5	1.1
2	305	273	32	310	160	25	145	378	165	120	9.5	1.8
4	315	283	32	435	220	25	175	503	195	150	9.5	3.5
[1] 3A version (Ra ≤ 0.8 µm/150 grit. Option: Ra ≤ 0.4 µm/240 grit)												

Dimensions Promass A: 4-VCO-4 connection with mounting set DN 15 flange EN 1092-1 (DIN 2501), JIS or 1/2" flange (ANSI)

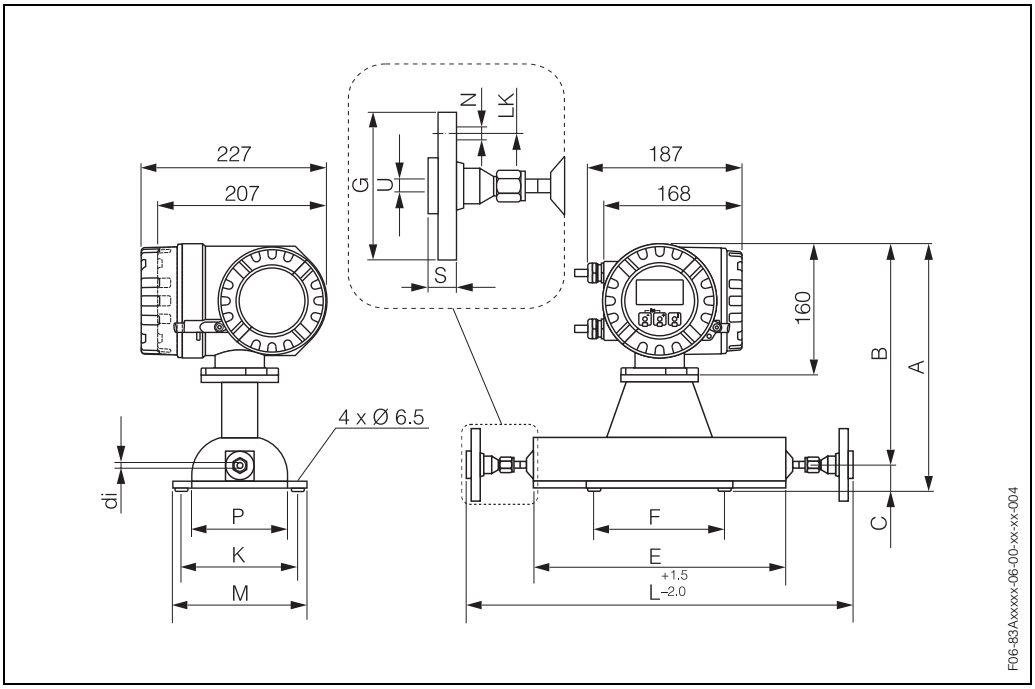


Fig. 87: Dimensions Promass A: 4-VCO-4 connection with mounting set DN 15 flange EN 1092-1 (DIN 2501), JIS or 1/2" flange (ANSI)

Mounting set DN 15 flange EN 1092-1 (DIN 2501) PN 40: 1.4539/904L, Alloy C-22
Surface roughness (flange): EN 1092-1 Form B1 (DIN 2526 Form C), Ra 6.3...12.5 µm

DN	A	B	C	E	F	G	K	L	M	N	P	S	LK	U	di
1	305	273	32	228	160	95	145	393	165	4 x Ø14	120	28	65	17.3	1.1
2	305	273	32	310	160	95	145	475	165	4 x Ø14	120	28	65	17.3	1.8
4	315	283	32	435	220	95	175	600	195	4 x Ø14	150	28	65	17.3	3.5
Loose flanges (not fluid-wetted) made of stainless steel 1.4404/316L															

Mounting set DN 15 flange (JIS) 10K: 1.4539/904L, Alloy C-22
Surface roughness (flange): Ra 3.2...6.3 µm

DN	A	B	C	E	F	G	K	L	M	N	P	S	LK	U	di
1	305	273	32	228	160	95	145	393	165	4 x Ø15	120	20	70	15.0	1.1
2	305	273	32	310	160	95	145	475	165	4 x Ø15	120	20	70	15.0	1.8
4	315	283	32	435	220	95	175	600	195	4 x Ø15	150	20	70	15.0	3.5
Loose flanges (not fluid-wetted) made of stainless steel 1.4404/316L															

Mounting set DN 15 flange (JIS) 20K: 1.4539/904L, Alloy C-22
Surface roughness (flange): Ra 3.2...6.3 µm

DN	A	B	C	E	F	G	K	L	M	N	P	S	LK	U	di
1	305	273	32	228	160	95	145	393	165	4 x Ø15	120	14	70	15.0	1.1
2	305	273	32	310	160	95	145	475	165	4 x Ø15	120	14	70	15.0	1.8
4	315	283	32	435	220	95	175	600	195	4 x Ø15	150	14	70	15.0	3.5

Mounting set 1/2" flange (ANSI) Cl 150: 1.4539/904L, Alloy C-22 Surface roughness (flange): Ra 3.2...6.3 µm																
DN		A	B	C	E	F	G	K	L	M	N	P	S	LK	U	di
1	1/24"	305	273	32	228	160	88.9	145	393	165	4 x Ø15.7	120	17.7	60.5	15.7	1.1
2	1/12"	305	273	32	310	160	88.9	145	475	165	4 x Ø15.7	120	17.7	60.5	15.7	1.8
4	1/8"	315	283	32	435	220	88.9	175	600	195	4 x Ø15.7	150	17.7	60.5	15.7	3.5
Loose flanges (not fluid-wetted) made of stainless steel 1.4404/316L																

Mounting set 1/2" flange (ANSI) Cl 300: 1.4539/904L, Alloy C-22 Surface roughness (flange): Ra 3.2...6.3 µm																
DN		A	B	C	E	F	G	K	L	M	N	P	S	LK	U	di
1	1/24"	305	273	32	228	160	95.2	145	393	165	4 x Ø15.7	120	20.7	66.5	15.7	1.1
2	1/12"	305	273	32	310	160	95.2	145	475	165	4 x Ø15.7	120	20.7	66.5	15.7	1.8
4	1/8"	315	283	32	435	220	95.2	175	600	195	4 x Ø15.7	150	20.7	66.5	15.7	3.5
Loose flanges (not fluid-wetted) made of stainless steel 1.4404/316L																

Dimensions Promass A: 4-VCO-4 connection with mounting set 1/4" NPT-F

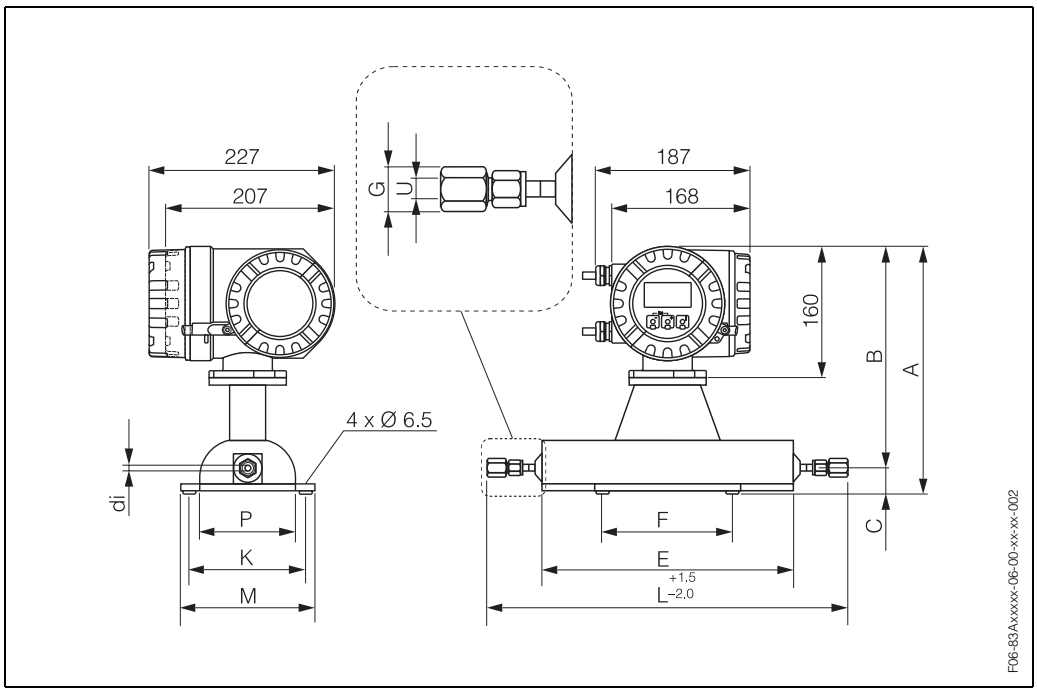


Fig. 88: Dimensions Promass A: 4-VCO-4 connection with mounting set 1/4" NPT-F

Mounting set 1/4" NPT-F connection: 1.4539/904L, Alloy C-22												
DN	A	B	C	E	F	G	K	L	M	P	U	di
1	305	273	32	228	160	SW 3/4"	145	361	165	120	1/4"-NPT	1.1
2	305	273	32	310	160	SW 3/4"	145	443	165	120	1/4"-NPT	1.8
2 [1)]	305	273	32	310	160	SW 3/4"	145	443	165	120	1/4"-NPT	1.4
4	315	283	32	435	220	SW 3/4"	175	568	195	150	1/4"-NPT	3.5
4 [1)]	315	283	32	435	220	SW 3/4"	175	568	195	150	1/4"-NPT	3.0
[1)] High pressure version available in 1.4539/904L only												

Dimensions Promass A:
4-VCO-4 connection with mounting set 1/8" or 1/4" SWAGELOK

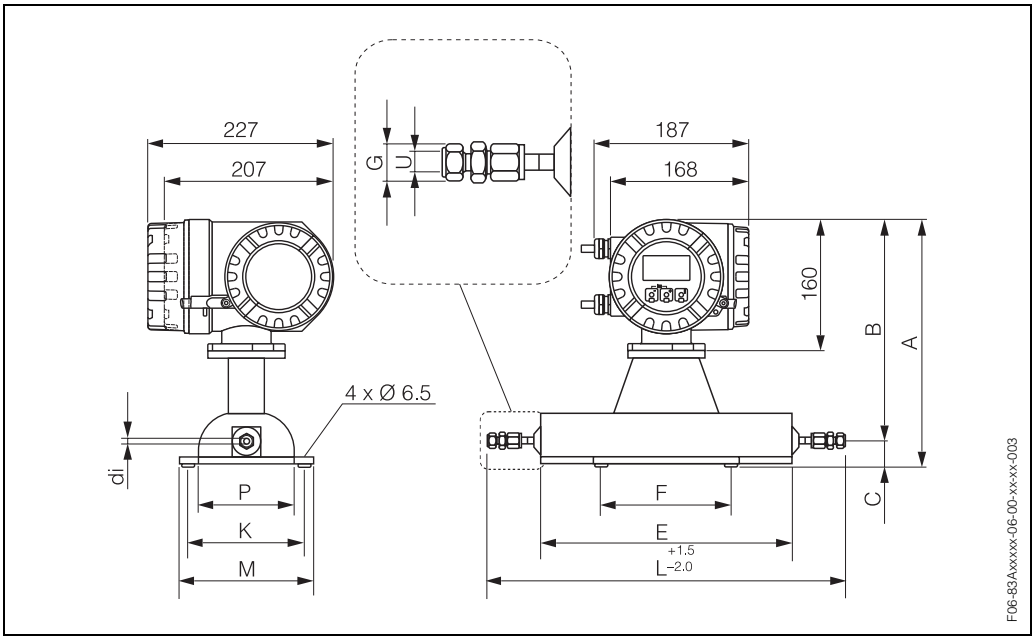


Fig. 89: Dimensions Promass A: 4-VCO-4 connection with mounting set 1/8" or 1/4" SWAGELOK

Mounting set SWAGELOK connection: 1.4401/316												
DN	A	B	C	E	F	G	K	L	M	P	U	di
1	305	273	32	228	160	SW 7/16"	145	359.6	165	120	1/8"	1.1
1	305	273	32	228	160	SW 9/16"	145	359.6	165	120	1/4"	1.1
2	305	273	32	310	160	SW 7/16"	145	441.6	165	120	1/8"	1.8
2	305	273	32	310	160	SW 9/16"	145	441.6	165	120	1/4"	1.8
2 [1)]	305	273	32	310	160	SW 7/16"	145	441.6	165	120	1/8"	1.4
2 [1)]	305	273	32	310	160	SW 9/16"	145	441.6	165	120	1/4"	1.4
4	315	283	32	435	220	SW 9/16"	175	571.6	195	150	1/4"	3.5
4 [1)]	315	283	32	435	220	SW 9/16"	175	571.6	195	150	1/4"	3.0
[1)] High pressure version												

Dimensions Promass A:
Purge connections / secondary containment monitoring

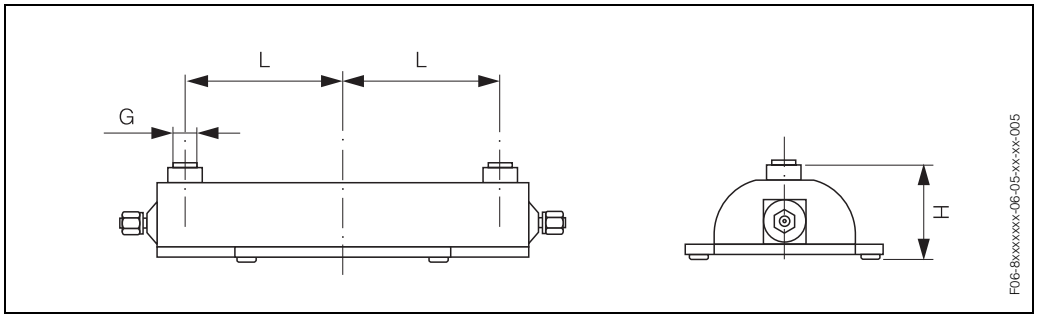


Fig. 90: Dimensions Promass A: purge connections / secondary containment monitoring

DN	L	H	G
1	92.0	102.0	1/2" NPT
2	130.0	102.0	1/2" NPT
4	192.5	113.1	1/2" NPT

10.13 Dimensions: Promass H

Dimensions Promass H: flange connections EN (DIN), ANSI, JIS

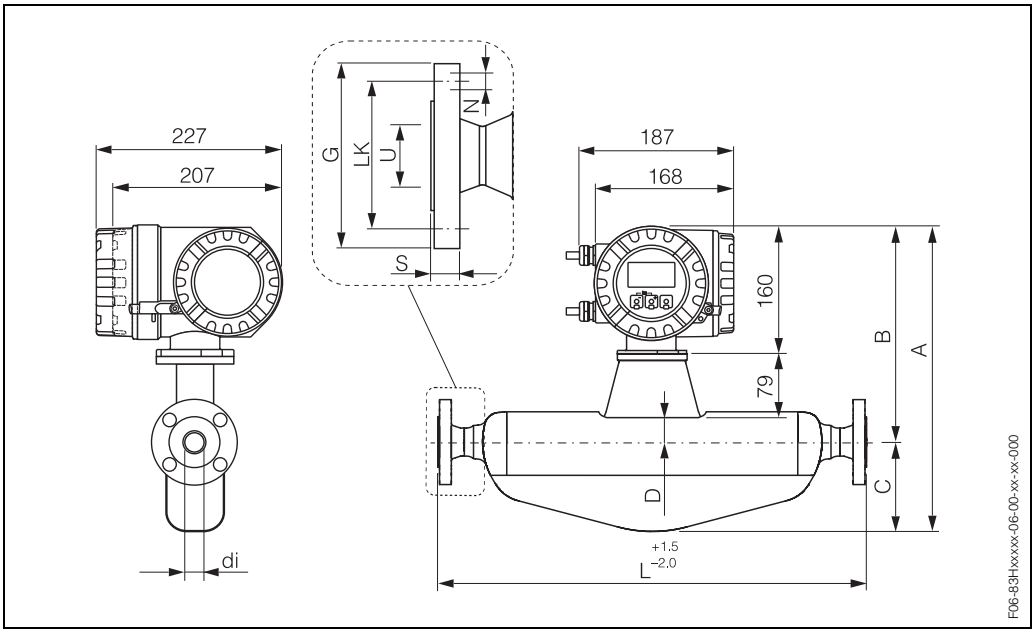


Abb. 91: Dimensions Promass H: flange connections EN (DIN), ANSI, JIS

Flange EN 1092-1 (DIN 2501) / PN 40: 1.4301/304, parts in contact with medium zirconium 702
Surface roughness (flange): EN 1092-1 Form B1 (DIN 2526 Form C), Ra 1.6...3.2 µm

DN	A	B	C	D	G	L	N	S	LK	U	di
8 [1]	384	280	104	41	95	336	4 x Ø14	20	65	17.30	8.51
15	385	280	105	41	95	440	4 x Ø14	20	65	17.30	12.00
25	401	280	121	41	115	580	4 x Ø14	19	85	28.50	17.60
40	475	304	171	65	150	794	4 x Ø18	21.5	110	43.10	25.50
50	556	315	241	76	165	1071	4 x Ø18	23.5	125	54.50	40.50

[1] DN 8 with DN 15 flanges as standard

Flange ANSI B16.5 / Cl 150: 1.4301/304, parts in contact with medium zirconium 702
Surface roughness (flange): Ra 3.2...6.3 µm

DN		A	B	C	D	G	L	N	S	LK	U	di
8 [1]	3/8"	384	280	104	41	88.9	336	4 x Ø15.7	12.8	60.5	15.70	8.51
15	1/2"	385	280	105	41	88.9	440	4 x Ø15.7	12.8	60.5	15.70	12.00
25	1"	401	280	121	41	108.0	580	4 x Ø15.7	15.1	79.2	26.70	17.60
40	1 1/2"	475	304	171	65	127.0	794	4 x Ø15.7	17.5	98.6	40.90	25.50
50	2"	556	315	241	76	152.4	1071	4 x Ø19.1	23.6	120.7	52.60	40.50

[1] DN 8 with DN 15 flanges as standard

Flange ANSI B16.5 / Cl 300: 1.4301/304, parts in contact with medium zirconium 702 Surface roughness (flange): Ra 3.2...6.3 µm												
DN		A	B	C	D	G	L	N	S	LK	U	di
8 [1]	3/8"	384	280	104	41	95.2	336	4 x Ø15.7	14.2	66.5	15.70	8.51
15	1/2"	385	280	105	41	95.2	440	4 x Ø15.7	14.2	66.5	15.70	12.00
25	1"	401	280	121	41	124.0	580	4 x Ø19.1	17.5	88.9	26.70	17.60
40	1 1/2"	475	304	171	65	155.4	794	4 x Ø22.3	20.6	114.3	40.90	25.50
50	2"	556	315	241	76	165.1	1071	8 x Ø19.1	23.6	127	52.60	40.50
[1] DN 8 with DN 15 flanges as standard												

Flange JIS B2238 / 20K: 1.4301/304, parts in contact with medium zirconium 702 Surface roughness (flange): Ra 3.2...6.3 µm											
DN	A	B	C	D	G	L	N	S	LK	U	di
8 [1]	384	280	104	41	95	336	4 x Ø15	14	70	15.00	8.51
15	385	280	105	41	95	440	4 x Ø15	14	70	15.00	12.00
25	401	280	121	41	125	580	4 x Ø19	16	90	25.00	17.60
40	475	304	171	65	140	794	4 x Ø19	18	105	40.00	25.50
50	556	315	241	76	155	1071	8 x Ø19	22	120	50.00	40.50
[1] DN 8 with DN 15 flanges as standard											

Dimensions Promass H: purge connections / secondary containment monitoring

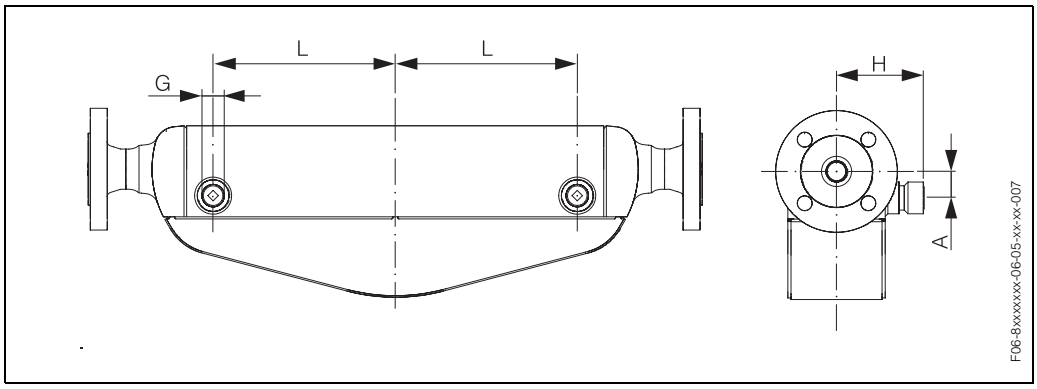


Fig. 92: Dimensions Promass H: purge connections / secondary containment monitoring

DN	L	H	A	G
8	55	82	25	1/2" NPT
15	102	82	25	1/2" NPT
25	172	82	25	1/2" NPT
40	263	102	45	1/2" NPT
50	381.5	119.5	58	1/2" NPT

10.14 Dimensions: Promass I

Dimensions Promass I: flange connections EN (DIN), ANSI, JIS

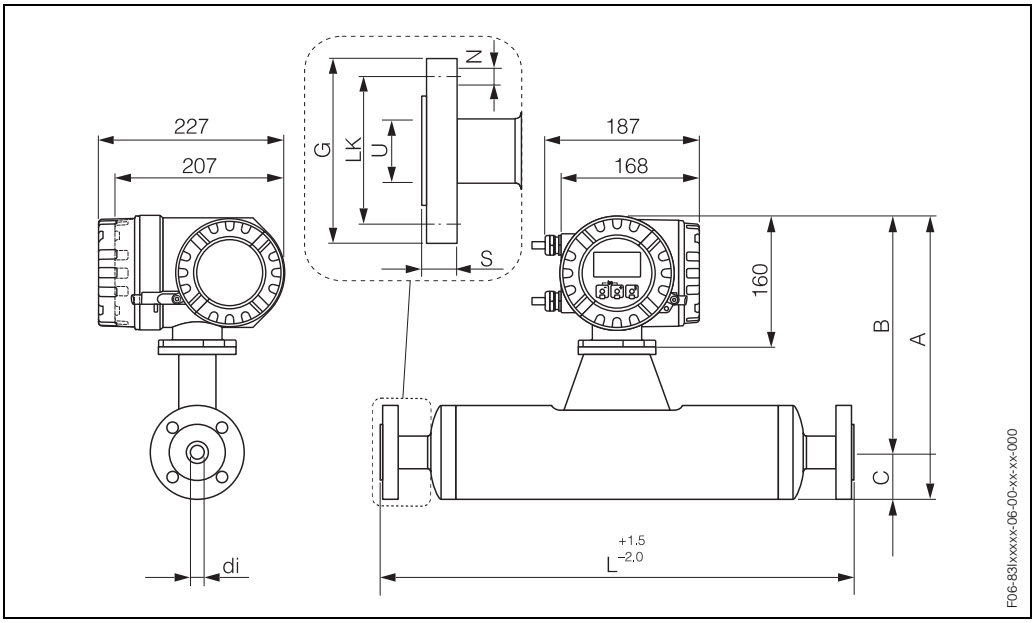


Fig. 93: Dimensions Promass I: flange connections EN (DIN), ANSI, JIS

Flange EN 1092-1 (DIN 2501) / PN 40: 1.4301/304, parts in contact with medium titanium grade 9 Surface roughness (flange): EN 1092-1 Form B1 (DIN 2526 Form C), Ra 6.3...12.5 µm										
DN	A	B	C	G	L	N	S	LK	U	di
8 [1]	350	291	59	95	402	4 x Ø14	20	65	17.30	8.55
15	350	291	59	95	438	4 x Ø14	20	65	17.30	11.38
15 [2]	350	291	59	95	572	4 x Ø14	19	65	17.07	17.07
25	350	291	59	115	578	4 x Ø14	23	85	28.50	17.07
25 [2]	377	305	72	115	700	4 x Ø14	22	85	25.60	25.60
40	377	305	72	150	708	4 x Ø18	26	110	43.10	25.60
40 [2]	406	320	86	150	819	4 x Ø18	24	110	35.62	35.62
50	406	320	86	165	827	4 x Ø18	28	125	54.50	35.62
[1] DN 8 with DN 15 flanges as standard [2] DN 15, 25, 40 “FB” = Full bore versions of Promass I										

Flange EN 1092-1 (DIN 2501) / PN 63: 1.4301/304, parts in contact with medium titanium grade 9 Surface roughness (flange): EN 1092-1 Form B2 (DIN 2526 Form E), Ra 1.6...3.2 µm										
DN	A	B	C	G	L	N	S	LK	U	di
50	406	320	86	180	832	4 x Ø22	34	135	54.5	35.62

Flange EN 1092-1(DIN 2501) / PN 100: 1.4301/304, parts in contact with medium titanium grade 9 Surface roughness (flange): EN 1092-1 Form B2 (DIN 2526 Form E), Ra 1.6...3.2 µm										
DN	A	B	C	G	L	N	S	LK	U	di
8 [1]	350	291	59	105	402	4 x Ø14	25	75	17.30	8.55
15	350	291	59	105	438	4 x Ø14	25	75	17.30	11.38
15 [2]	350	291	59	105	578	4 x Ø14	26	75	17.07	17.07
25	350	291	59	140	578	4 x Ø18	29	100	28.50	17.07
25 [2]	377	305	72	140	706	4 x Ø18	31	100	25.60	25.60
40	377	305	72	170	708	4 x Ø22	32	125	42.50	25.60
40 [2]	406	320	86	170	825	4 x Ø22	33	125	35.62	35.62
50	406	320	86	195	832	4 x Ø26	36	145	53.90	35.62
[1] DN 8 with DN 15 flanges as standard [2] DN 15, 25, 40 “FB” = Full bore versions of Promass I										

Flange ANSI B16.5 / Cl 150: 1.4301/304, parts in contact with medium titanium grade 9
Surface roughness (flange): Ra 3.2...6.3 µm

DN		A	B	C	G	L	N	S	LK	U	di
8 [1]	3/8"	350	291	59	88.9	402	4 x Ø15.7	20	60.5	15.70	8.55
15	1/2"	350	291	59	88.9	438	4 x Ø15.7	20	60.5	15.70	11.38
15 [2]	1/2"	350	291	59	88.9	572	4 x Ø15.7	19	60.5	17.07	17.07
25	1"	350	291	59	108.0	578	4 x Ø15.7	23	79.2	26.70	17.07
25 [2]	1"	377	305	72	108.0	700	4 x Ø15.7	22	79.2	25.60	25.60
40	1 1/2"	377	305	72	127.0	708	4 x Ø15.7	26	98.6	40.90	25.60
40 [2]	1 1/2"	406	320	86	127.0	819	4 x Ø15.7	24	98.6	35.62	35.62
50	2"	406	320	86	152.4	827	4 x Ø19.1	28	120.7	52.60	35.62

[1] DN 8 with DN 15 flanges as standard
[2] DN 15, 25, 40 “FB” = Full bore versions of Promass I

Flange ANSI B16.5 / Cl 300: 1.4301/304, parts in contact with medium titanium grade 9
Surface roughness (flange): Ra 3.2...6.3 µm

DN		A	B	C	G	L	N	S	LK	U	di
8 [1]	3/8"	350	291	59	95.3	402	4 x Ø15.7	20	66.5	15.70	8.55
15	1/2"	350	291	59	95.3	438	4 x Ø15.7	20	66.5	15.70	11.38
15 [2]	1/2"	350	291	59	95.3	572	4 x Ø15.7	19	66.5	17.07	17.07
25	1"	350	291	59	124.0	578	4 x Ø19.1	23	88.9	26.70	17.07
25 [2]	1"	377	305	72	124.0	700	4 x Ø19.1	22	88.9	25.60	25.60
40	1 1/2"	377	305	72	155.4	708	4 x Ø22.4	26	114.3	40.90	25.60
40 [2]	1 1/2"	406	320	86	155.4	819	4 x Ø22.4	24	114.3	35.62	35.62
50	2"	406	320	86	165.1	827	8 x Ø19.1	28	127.0	52.60	35.62

[1] DN 8 with DN 15 flanges as standard
[2] DN 15, 25, 40 “FB” = Full bore versions of Promass I

Flange ANSI B16.5 / Cl 600: 1.4301/304, parts in contact with medium titanium grade 9
Surface roughness (flange): Ra 3.2...6.3 µm

DN		A	B	C	G	L	N	S	LK	U	di
8 [1]	3/8"	350	291	59	95.3	402	4 x Ø15.7	20	66.5	13.80	8.55
15	1/2"	350	291	59	95.3	438	4 x Ø15.7	20	66.5	13.80	11.38
15 [2]	1/2"	350	291	59	95.3	578	4 x Ø15.7	22	66.5	17.07	17.07
25	1"	350	291	59	124.0	578	4 x Ø19.1	23	88.9	24.40	17.07
25 [2]	1"	377	305	72	124.0	706	4 x Ø19.1	25	88.9	25.60	25.60
40	1 1/2"	377	305	72	155.4	708	4 x Ø22.4	28	114.3	38.10	25.60
40 [2]	1 1/2"	406	320	86	155.4	825	4 x Ø22.4	29	114.3	35.62	35.62
50	2"	406	320	86	165.1	832	8 x Ø19.1	33	127.0	49.30	35.62

[1] DN 8 with DN 15 flanges as standard
[2] DN 15, 25, 40 “FB” = Full bore versions of Promass I

Flange JIS B2238 / 10K: 1.4301/304, parts in contact with medium titanium grade 9
Surface roughness (flange): Ra 3.2...6.3 µm

DN	A	B	C	G	L	N	S	LK	U	di
50	406	320	86	155	827	4 x Ø19	28	120	50	35.62

Flange JIS B2238 / 20K: 1.4301/304, parts in contact with medium titanium grade 9
Surface roughness (flange): Ra 3.2...6.3 µm

DN	A	B	C	G	L	N	S	LK	U	di
8 [1]	350	291	59	95	402	4 x Ø15	20	70	15.00	8.55
15	350	291	59	95	438	4 x Ø15	20	70	15.00	11.38
15 [2]	350	291	59	95	572	4 x Ø15	19	70	17.07	17.07
25	350	291	59	125	578	4 x Ø19	23	90	25.00	17.07
25 [2]	377	305	72	125	700	4 x Ø19	22	90	25.60	25.60
40	377	305	72	140	708	4 x Ø19	26	105	40.00	25.60
40 [2]	406	320	86	140	819	4 x Ø19	24	105	35.62	35.62
50	406	320	86	155	827	8 x Ø19	28	120	50.00	35.62

[1] DN 8 with DN 15 flanges as standard
[2] DN 15, 25, 40 “FB” = Full bore versions of Promass I

Flange JIS B2238 / 40K: 1.4301/304, parts in contact with medium titanium grade 9
Surface roughness (flange): Ra 3.2...6.3 µm

DN	A	B	C	G	L	N	S	LK	U	di
8 [1]	350	291	59	115	402	4 x Ø19	25	80	15.00	8.55
15	350	291	59	115	438	4 x Ø19	25	80	15.00	11.38
15 [2]	350	291	59	115	578	4 x Ø19	26	80	17.07	17.07
25	350	291	59	130	578	4 x Ø19	27	95	25.00	17.07
25 [2]	377	305	72	130	706	4 x Ø19	29	95	25.60	25.60
40	377	305	72	160	708	4 x Ø23	30	120	38.00	25.60
40 [2]	406	320	86	160	825	4 x Ø23	31	120	35.62	35.62
50	406	320	86	165	827	8 x Ø19	32	130	50.00	35.62

[1] DN 8 with DN 15 flanges as standard
[2] DN 15, 25, 40 “FB” = Full bore versions of Promass I

Flange JIS B2238 / 63K: 1.4301/304, parts in contact with medium titanium grade 9
Surface roughness (flange): Ra 3.2...6.3 µm

DN	A	B	C	G	L	N	S	LK	U	di
8 [1]	350	291	59	120	402	4 x Ø19	28	85	12.00	8.55
15	350	291	59	120	438	4 x Ø19	28	85	12.80	11.38
15 [2]	350	291	59	120	578	4 x Ø19	29	85	17.07	17.07
25	350	291	59	140	578	4 x Ø23	30	100	22.00	17.07
25 [2]	377	305	72	140	706	4 x Ø23	32	100	25.60	25.60
40	377	305	72	175	708	4 x Ø25	36	130	35.00	25.60
40 [2]	406	320	86	175	825	4 x Ø25	37	130	35.62	35.62
50	406	320	86	185	832	8 x Ø23	40	145	48.00	35.62

[1] DN 8 with DN 15 flanges as standard
[2] DN 15, 25, 40 “FB” = Full bore versions of Promass I

Dimensions Promass I: Tri-Clamp connections

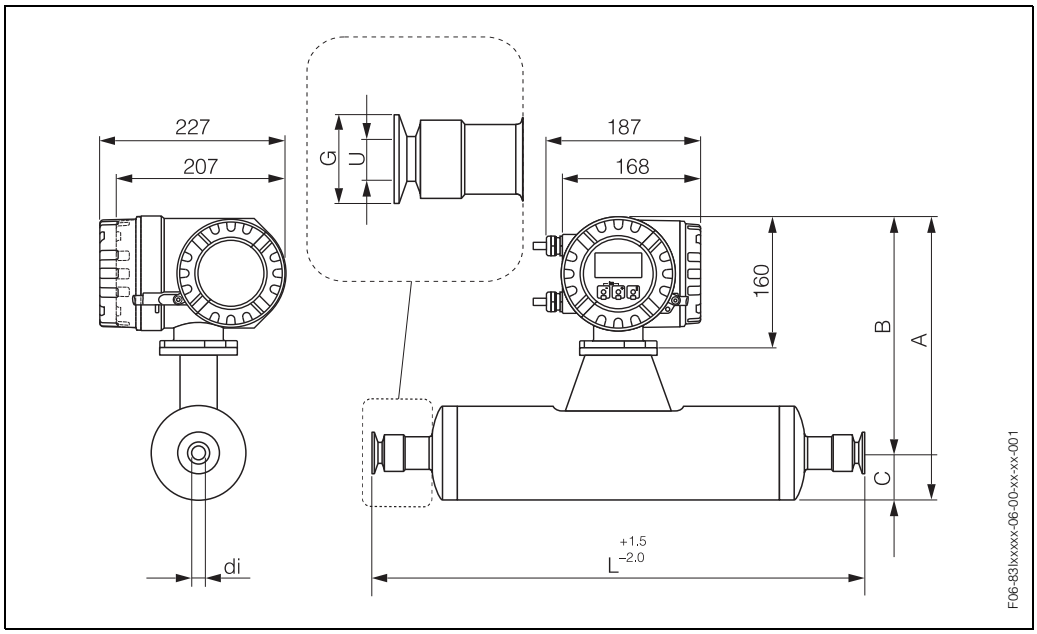


Fig. 94: Dimensions Promass I: Tri-Clamp connections

Tri-Clamp / 3A version[1]: titanium grade 2								
DN	Clamp	A	B	C	G	L	U	di
8	1"	350	291	59	50.4	427	22.1	8.55
15	1"	350	291	59	50.4	463	22.1	11.38
15 [2]	see 3/4" Tri-Clamp connection							
25	1"	350	291	59	50.4	603	22.1	17.07
25 [2]	1"	377	305	72	50.4	730	22.1	25.60
40	1 1/2"	377	305	72	50.4	731	34.8	25.60
40 [2]	1 1/2"	406	320	86	50.4	849	34.8	35.62
50	2"	406	320	86	63.9	850	47.5	35.62

[1] 3A version (Ra ≤ 0.8 µm/150 grit. Option: Ra ≤ 0.4 µm/240 grit)
[2] DN 15, 25, 40 "FB" = Full bore versions of Promass I

1/2" Tri-Clamp / 3A version[1]: titanium grade 2								
DN	Clamp	A	B	C	G	L	U	di
8	1/2"	350	291	59	25.0	426	9.5	8.55
15	1/2"	350	291	59	25.0	462	9.5	11.38

[1] 3A version (Ra ≤ 0.8 µm/150 grit. Option: Ra ≤ 0.4 µm/240 grit)

3/4" Tri-Clamp / 3A version[1]: titanium grade 2								
DN	Clamp	A	B	C	G	L	U	di
8	3/4"	350	291	59	25.0	426	16.0	8.55
15	3/4"	350	291	59	25.0	462	16.0	11.38
15 [2]	3/4"	350	291	59	25.0	602	16.0	17.07

[1] 3A version (Ra ≤ 0.8 µm/150 grit. Option: Ra ≤ 0.4 µm/240 grit)
[2] DN 15 "FB" = Full bore versions of Promass I

Dimensions Promass I: DIN 11851 connections (hygienic coupling)

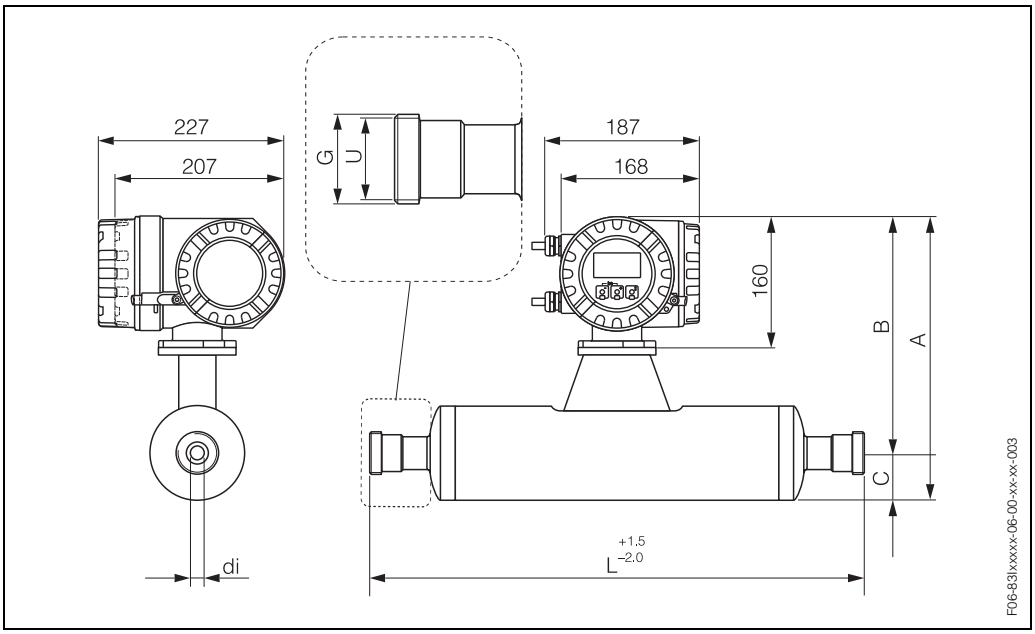


Fig. 95: Dimensions Promass I: DIN 11851 connections (hygienic coupling)

Hygienic coupling DIN 11851 / 3A version [1]: titanium grade 2							
DN	A	B	C	G	L	U	di
8	350	291	59	Rd 34 x 1/8"	427	16	8.55
15	350	291	59	Rd 34 x 1/8"	463	16	11.38
15 [2]	350	291	59	Rd 34 x 1/8"	602	16	17.07
25	350	291	59	Rd 52 x 1/6"	603	26	17.07
25 [2]	377	305	72	Rd 52 x 1/6"	736	26	25.60
40	377	305	72	Rd 65 x 1/6"	731	38	25.60
40 [2]	406	320	86	Rd 65 x 1/6"	855	38	35.62
50	406	320	86	Rd 78 x 1/6"	856	50	35.62
[1] 3A version (Ra ≤ 0.8 µm/150 grit) [2] DN 15, 25, 40 "FB" = Full bore versions of Promass I							

Hygienic coupling DIN 11851 Rd 28 x 1/8" / 3A version [1]: titanium grade 2							
DN	A	B	C	G	L	U	di
8	350	291	59	Rd 28 x 1/8"	426	10	8.55
15	350	291	59	Rd 28 x 1/8"	462	10	11.38
[1] 3A version (Ra ≤ 0.8 µm/150 grit)							

Dimensions Promass I: DIN 11864-1 Form A connections (couplings)

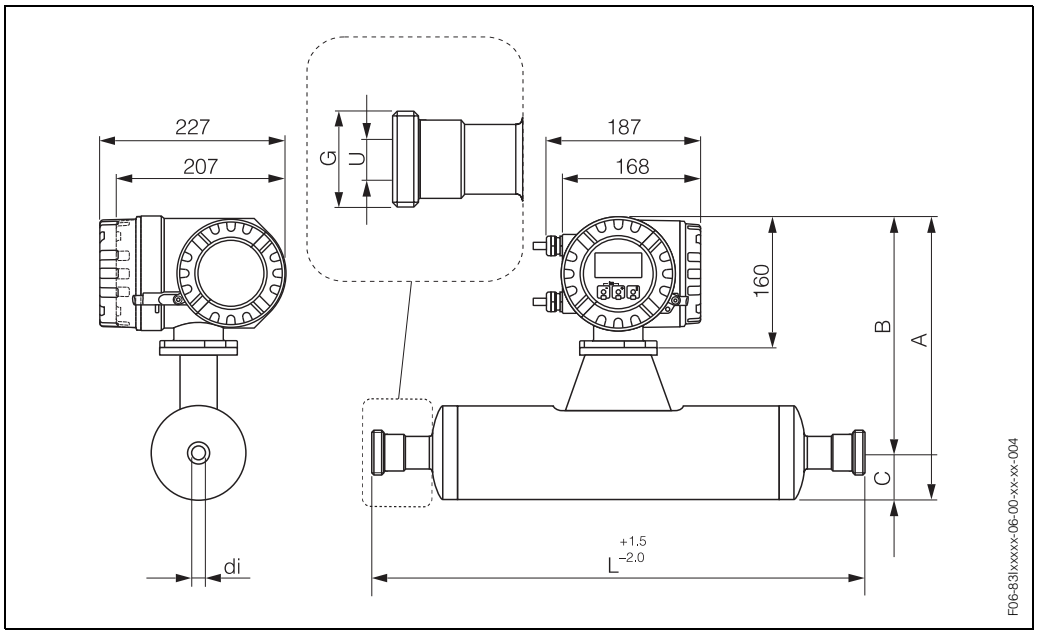


Fig. 96: Dimensions Promass I: DIN 11864-1 Form A connections (couplings)

Coupling DIN 11864-1 Form A / 3A version [1]: titanium grade 2							
DN	A	B	C	G	L	U	di
8 [2]	350	291	59	Rd 28 x 1/8"	428	10	8.55
15	350	291	59	Rd 34 x 1/8"	463	16	11.38
15 [3]	350	291	59	Rd 34 x 1/8"	602	16	17.07
25	350	291	59	Rd 52 x 1/6"	603	26	17.07
25 [3]	377	305	72	Rd 52 x 1/6"	734	26	25.60
40	377	305	72	Rd 65 x 1/6"	731	38	25.60
40 [3]	406	320	86	Rd 65 x 1/6"	855	38	35.62
50	406	320	86	Rd 78 x 1/6"	856	50	35.62

[1] 3A version (Ra ≤ 0.8 µm/150 grit. Option: Ra ≤ 0.4 µm/240 grit)
[2] DN 8 with DN 10 threaded adapters
[3] DN 15, 25, 40 “FB” = Full bore versions of Promass I

Dimensions Promass I: flange connection DIN 11864-2 Form A (flat flange)

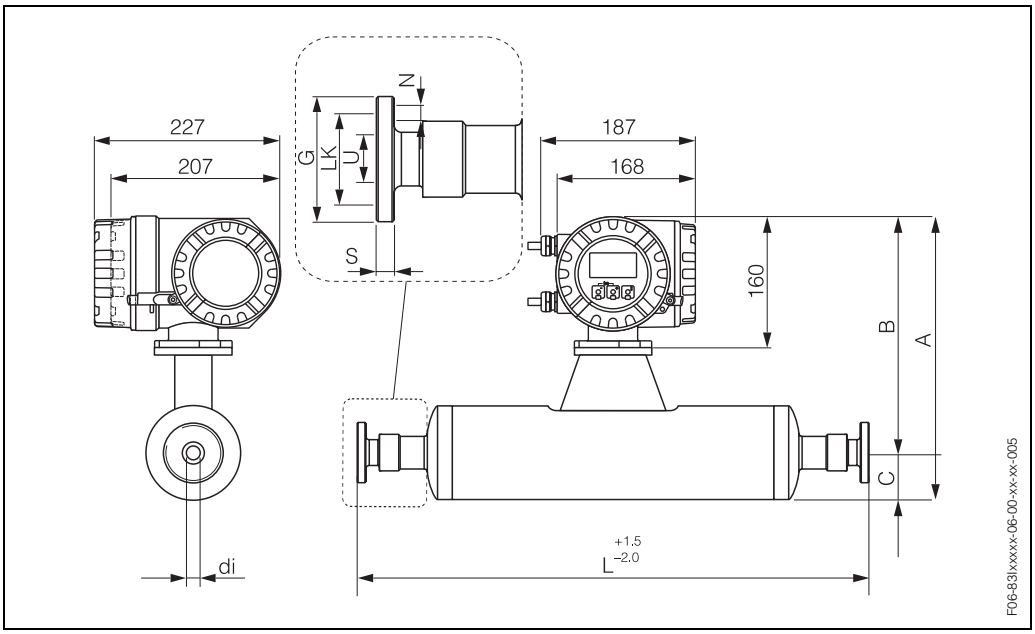


Fig. 97: Dimensions Promass I: flange connection DIN 11864-2 Form A (flat flange)

Flange DIN 11864-2 Form A (flat flange) / 3A version [1]: titanium grade 2										
DN	A	B	C	G	L	N	S	LK	U	di
8 [2]	350	291	59	54	449	4 x Ø9	10	37	10	8.55
15	350	291	59	59	485	4 x Ø9	10	42	16	11.38
25	350	291	59	70	625	4 x Ø9	10	53	26	17.07
40	377	305	72	82	753	4 x Ø9	10	65	38	25.60
50	406	320	86	94	874	4 x Ø9	10	77	50	35.62

[1] 3A version (Ra ≤ 0.8 µm/150 grit. Option: Ra ≤ 0.4 µm/240 grit)
[2] DN 8 with DN 10 flanges

Dimensions Promass I: ISO 2853 connections (couplings)

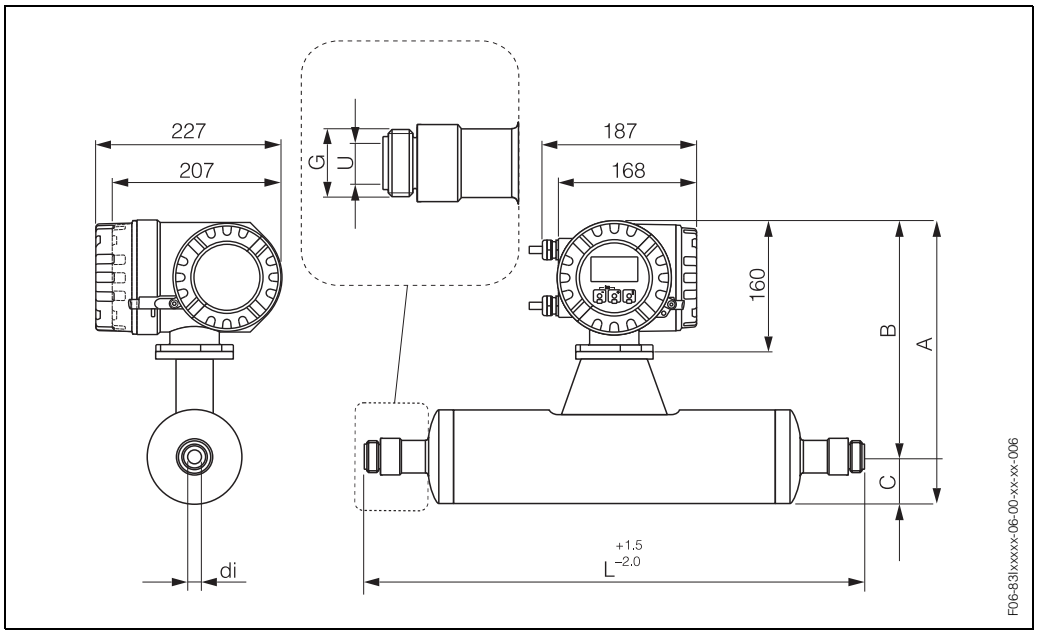


Fig. 98: Dimensions Promass I: ISO 2853 connections (couplings)

Coupling ISO 2853 / 3A version [1]: titanium grade 2							
DN	A	B	C	G	L	U	di
8 [2]	350	291	59	37.13	435	22.6	8.55
15	350	291	59	37.13	471	22.6	11.38
15 [3]	350	291	59	37.13	610	22.6	17.07
25 [3]	377	305	72	37.13	744	22.6	25.60
40	377	305	72	50.65	737	35.6	25.60
40 [3]	406	320	86	50.65	859	35.6	35.62
50	406	320	86	64.16	856	48.6	35.62

[1] 3A version (Ra ≤ 0.8 µm/150 grit. Option: Ra ≤ 0.4 µm/240 grit)
[2] DN 8 with DN 15 threaded adapters as standard
[3] DN 15, 25, 40 “FB” = Full bore versions of Promass I

Dimensions Promass I: SMS 1145 connections (hygienic coupling)

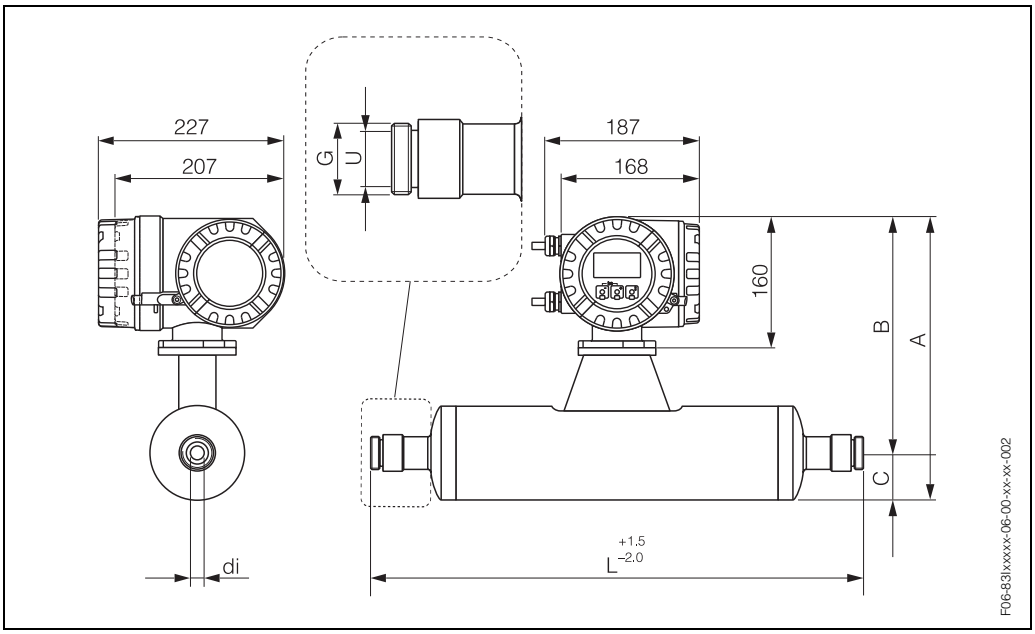


Fig. 99: Dimensions Promass I: SMS 1145 connections (hygienic coupling)

Hygienic coupling SMS 1145 / 3A version [1]: titanium grade 2							
DN	A	B	C	G	L	U	di
8	350	291	59	Rd 40 x 1/6"	427	22.5	8.55
15	350	291	59	Rd 40 x 1/6"	463	22.5	11.38
25	350	291	59	Rd 40 x 1/6"	603	22.5	17.07
25 [2]	377	305	72	Rd 40 x 1/6"	736	22.5	25.60
40	377	305	72	Rd 60 x 1/6"	738	35.5	25.60
40 [2]	406	320	86	Rd 60 x 1/6"	857	35.5	35.62
50	406	320	86	Rd 70 x 1/6"	858	48.5	35.62

[1] 3A version (Ra ≤ 0.8 µm/150 grit)
[2] DN 15, 25, 40 "FB" = Full bore versions of Promass I

Dimensions Promass I:
Purge connections / secondary containment monitoring

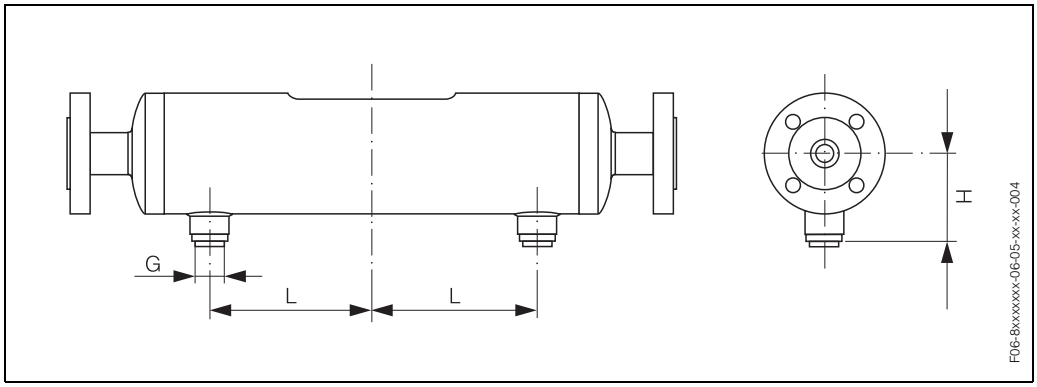


Fig. 100: Dimensions Promass I: purge connections / secondary containment monitoring

DN	L	H	G
8 [2]	61	90.65	1/2" NPT
15	79	90.65	1/2" NPT
15 [1]	79	90.65	1/2" NPT
25	148	90.65	1/2" NPT
25 [1]	148	90.65	1/2" NPT
40	196	103.35	1/2" NPT
40 [1]	196	103.35	1/2" NPT
50	244	117.75	1/2" NPT

[1] DN 15, 25, 40 “FB” = Full bore versions of Promass I
[2] DN 8 with DN 15 flanges as standard

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Declaration of contamination

Dear customer,
Because of legal determinations and for the safety of our employees and operating equipment we need this "Declaration of contamination" with your signature before your order can be handled. Please put the completely filled in declaration to the instrument and to the shipping documents in any case. Add also safety sheets and/or specific handling instructions if necessary.

type of instrument / sensor: _____ serial number: _____

medium / concentration: _____ temperature: _____ pressure: _____

cleaned with: _____ conductivity: _____ viscosity: _____

Warning hints for medium used:

☐ radioactive ☐ explosive ☐ caustic ☐ poisonous ☐ harmful to health ☐ biologically hazardous ☐ inflammable ☐ safe

Please mark the appropriate warning hints.

Reason for return:

_____

_____

Company data:

company: _____ contact person: _____

_____ _____

_____ department: _____

address: _____ phone number: _____

_____ fax / e-mail: _____

_____ your order no.: _____

I hereby certify that the returned equipment has been cleaned and decontaminated acc. to good industrial practices and is in compliance with all regulations. This equipment poses no health or safety risks due to contamination.

_____ _____

(Date) (company stamp and legally binding signature)

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